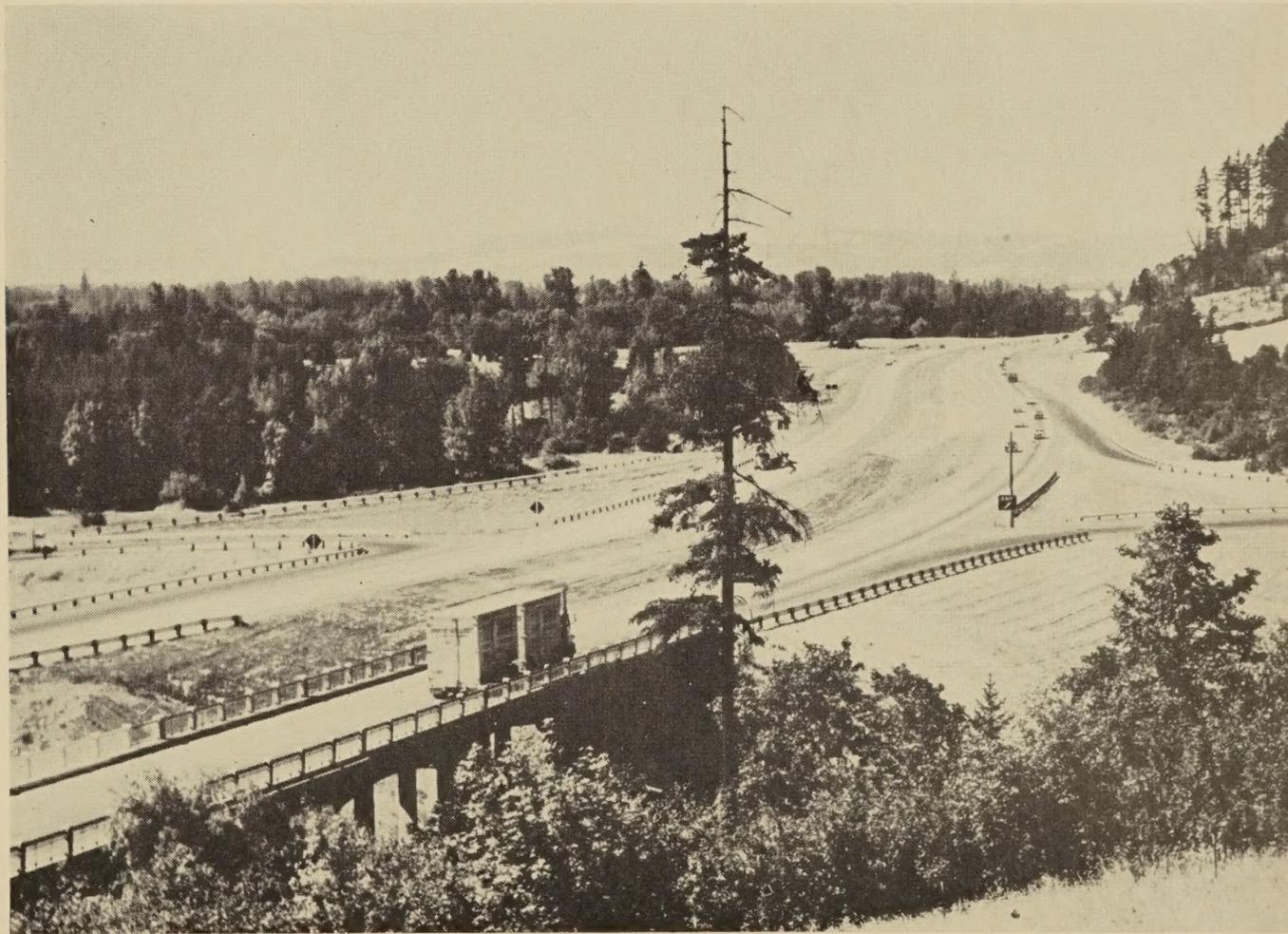


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View of the North Jefferson Junction in the North Albany Junction section of the Oregon-Pacific Highway, Interstate Route 5.



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Economic Evidence in Right-of-Way Litigation

BY THE
HIGHWAY AND LAND ADMINISTRATION DIVISION
BUREAU OF PUBLIC ROADS

Reported ¹ by SIDNEY GOLDSTEIN,² Chief,
Economic Impact Research Branch

The information presented in this article is the result of research directed toward providing facts that will be helpful in obtaining legal acceptance of economic research evidence in highway right-of-way litigation. Research evidence has been recognized in other fields of law, and it is believed that such recognition should be extended to highway litigation—economic fact should serve the court in establishing legal fact. A description and analysis of present evidentiary rules and tests are included, and suggestions have been made for the utilization of various types of evidentiary material. Hurdles that must be overcome before some of the evidentiary material becomes fully acceptable also have been described, and some of the means for countering judicial objections have been enumerated.

Acceptance and utilization of economic research evidence, such as that provided by land economic studies, severance damage studies, and economic statistical studies, is considered desirable for calculating just compensation, especially for partial takings for highway construction. Partial takings of property on a wholesale basis is a relatively new item in condemnation law. For example, in connection with the National System of Interstate and Defense Highways, approximately 90 percent of its 41,000 miles will be obtained from rural areas, and acquisition of almost any rural parcel of land will involve a partial taking. Heretofore, valuation by appraisers and realtors has been based primarily upon experience with entire parcels of land. Now, when an evaluation must be made for the remainder after a partial taking, damages must be determined also for the severance, and in some States the benefits accruing to the property from the highway must be segregated from the damages.

The benefits, including savings of both time and money for governmental entities, to be gained by the use of economic research as direct evidence of values are pointed out in this article. It also is proposed that legal counsel and courts re-examine their position with regard to acceptance of currently available economic data and that obtained from systematic research procedures.

ECONOMIC DATA IN CONDEMNATION PROCEEDINGS

Introduction

THE MERGING of ideas from two fields even under ideal circumstances is a difficult process. In the case of the disciplines of law and economics, however, this process has been going on for many centuries; present commercial legal practice evolved from the need for rules to implement various institutional relationships in our economic affairs. As a consequence, the development of procedural and substantive law involves a recognition of the business climate. While the law recognizes various economic arrangements, newer means of ascertaining facts exist today. The newer techniques of factual presentation can aid highway and other public officials greatly in their determination of fair compensation for property acquisition. To aid in the refinement of this fact gathering and in an attempt to determine true indicators of value for use in legal proceedings, the Bureau of Public Roads and many State highway departments

are engaged in right-of-way and legal research studies. Included in this research are land economic studies, severance damage studies, and economic impact studies.

From such research activities, it is hoped that it will be possible to supply the realities behind the market and the willing buyer-and-seller concepts, abstractions that have been defined fairly specifically in case law, as will be described later. Substantial savings to the Government, as well as verification and justification of condemnation awards, are expected from this research.

The partial takings of property for highway purposes has made more significant the current law of severance damages and the proof necessary in such cases. Although some 9 out of 10 condemnation cases are settled prior to recourse to judicial procedures, those that find their way to the courts oftentimes represent widely varying amounts of valuation for the same parcel of land. The pattern of payments of damages, in present as well as in future cases, is influenced by these interpretations and decisions arrived at in open court. The damages awarded in these cases tend to

establish the basis for the level of awards and damages in present appraisal practice since they become part of the jurisprudence kit.

The material presented in this paper on the economic orientation of condemnation cases, and the suggestions for the utilization of various types of evidentiary materials in such cases, indicate a belief that economic fact should serve the court in establishing legal fact. Existing legal practices, with respect to the admission and use of research evidence in courts of law, indicate that economic research techniques have made definite contributions to the judicial fact-finding and decision-making processes. Such findings almost invariably have been confined to areas of commercial litigation with the exception, however, of certain scientific tables and calculations, which are said to be admissible and competent evidence because the demands of custom and practical convenience make them generally, if not universally, acceptable.

Study of research findings

This study of the experience with economic research findings, where they are judicially acceptable, along with the indicated needs emerging from condemnation proceedings for factual data that best can be obtained by research methods, sanctions the admission and use of such findings in land valuation cases. Such sanctions, if adhered to, demand a reshaping of the rules of evidence, which now prohibit entrance of economic research findings as independent evidence in condemnation proceedings. Such a change in evidentiary procedure only summons the next step in the evolutionary process set in motion by the admission of comparable sales of particular parcels. If evidence of sales of comparable parcels can be introduced in piecemeal form, through the drawn-out procedure of separately and individually establishing the collateral issue of comparability followed by evidence of the sales prices, better procedural methods of introducing evidence pertaining to land values should be welcome because of the time factor and the need for better information.

¹ Presented at the 41st annual meeting, Highway Research Board, Washington, D.C., January 1962.

² William H. Stanhagen, formerly Chief, Highway Laws Project, assisted during the planning stage of this article; and law students who were employees of the Bureau of Public Roads, Joseph T. Sweeney and Carrie L. Fair, performed research and contributed to the preliminary preparation of this article.

Land economic studies, severance damage studies, economic statistics, and other research data can provide these better procedural needs and also overcome the shortage of land valuation data, essential in the determination of just compensation. The goal for all condemnation proceedings is the award of just compensation. Because such an award depends on property value, damages, and frequently benefits assigned to the land in question, it follows that these may be determined more accurately by objective research methods. The products of these methods could serve as a means both for substantiating or cross-examining expert testimony and for independent evidence, especially on issues such as: (1) after value, where the before-and-after formula is applied; (2) severance damages; (3) special benefits; and (4) general benefits. Therefore, better valuations of damages to properties, especially to remainder parcels, would be expected.

Filling in Evidentiary Gaps

Participants in the judicial process in eminent domain proceedings for highway purposes have recognized the need for sharpening factual presentations in condemnation cases. A recognition of this need has been seen in the recent emphasis on pretrial practice (1),³ on uniform expert appraisal testimony (2), and on severance damage studies (3). In this article the major emphasis has been placed on severance damage studies; a brief reference has been made to the other two items.

An objective for this article is to fill the gaps in evidentiary practice so that both the court and the jury will be assisted in their decision-making roles. The public and individual property owners will benefit by any reduction of guesswork that may be inherent in courtroom valuation of property. Concerned by the inadequacies of the factual presentations currently being admitted in the courtroom, various leaders in the right-of-way, appraisal, and legal fields have indicated a need for devices in dealing with certain types of property (4).

As an example of this concern, a specialist in right-of-way has referred to the valuation of severance damages in the following manner: "One of the most difficult phases of appraisal work is the assignment of the proper value of severance damages to properties in highway right-of-way acquisition" (5).

The desire of right-of-way officials to provide for fair and accurate compensation has been stated, as follows: "It is the general intent that owners of parcels that are severed or reduced in size by right-of-way acquisition be compensated as accurately as possible for damage incurred—that payment be no more, no less, than the true value" (5).

Evidence in condemnation cases turns on the question of the value of the property taken, and in partial taking cases on this as well as damages to the remainder. In accord-

ance with the established valuation procedures, properties are analyzed in terms of before and after the taking. In this connection, it is essential to realize that market value must always be an estimate. Even under the most refined expert appraisal, no two properties can ever be exactly alike in value because of the intangibles of location and quality, as well as the differences in background and training of appraisers. Since estimated values are the bases for the determination of fair and just compensation to a property owner, it is worthwhile to ask what can be added to the right-of-way official's technical equipment that also will aid the courts in increasing the accuracy of the estimate of value.

The most usual means of proving value in a court proceeding is by expert testimony in which experts or informed individuals on both sides seek to impress the jury with the defensibility of their valuations. The recognition of new legal evidentiary devices has indicated that the law has progressed substantially. Therefore, the type of evidence generally used in condemnation proceedings may be improved to meet present fact situations in highway condemnation cases. An analysis of the current status of the law of proof and of the admissibility of economic research evidence, such as statistical surveys and samples, and the hearsay objection to such data will be presented later in this article. The particular significance of various types of land economic studies to the highway lawyer and appraiser are discussed in the following paragraphs.

General Economic Impact

In condemnation law, the courts introduce some legal constructs; namely, market value and highest and best use as the determinant of fair and just compensation. Just as in other areas of law, that is in torts, the concepts of the prudent man and the reasonable man are used. Such generalized concepts are needed in order to furnish standards so that a fair decision may be obtained for all concerned. The impact of eminent domain proceedings on the general public has grown with the tremendous building programs currently in progress, some of which are: The Interstate and other Federal-aid highway programs, State and county highway construction efforts, urban renewal and redevelopment, reclamation, flood control, parks, and other programs involving the assignment of compensation.

Despite the technological advances illustrated by all these public works programs, the means of proof has tended to remain within the same paths. Further information is presented in this article in connection with the discussion of pertinent laws of eminent domain and evidence. Courts normally, however, adapt their current procedures to new problems, for this is how growth obtains in the law to handle growth in the economic system.

When an expert witness is giving his opinion of the value of a parcel taken and damages to the remainder, knowledge of land value trends is an indispensable item to him. He would like to be able to ascertain certain

general trends in the area so that he can give due credit to such general inflationary or deflationary movements in arriving at his estimate of value. General land value studies provide him with the expert information that he requires.

Information available

It is decidedly difficult and expensive for the individual appraiser to make a thorough study of all land value items in an area. For this reason, the Bureau of Public Roads, State highway departments, and various universities through economic impact studies are making available, to the appraisal profession and highway legal counsel, the types of information needed (6). Some of the background of these economic impact studies is given in the following paragraphs. The earlier studies of the 1920's were concerned with rural land values. References to the results of these and many recent land value studies, perhaps 50 in number, have appeared in the report of the highway cost allocation study, prepared for the U.S. Congress by the Bureau of Public Roads (7). In all, about 100 highway impact studies have been completed and presently about 40 are underway in some 35 States.

The impact studies have utilized various kinds of approaches. In general, the methodology encompassed what has been called a before-and-after technique—an analysis of some period prior to a highway improvement compared with a period after the completion of the improvement. Wherever possible, geographic areas subject to highway influences were compared with similar areas not subject to highway influence, in order to isolate to some degree the impact of the facility. Although the subject matter in these studies varies widely, the concern with right-of-way is seen in these studies because analyses of land value are usually a component part of any study for evaluating the impact of a highway.

The results of the experience gained in these studies have, in some instances, found their way into the courts, generally through expert presentation. One of the early impact studies that dealt with 2,500 sales in the Houston, Tex., area was used in a Mississippi case as a basis for expert opinion (8). Other studies provide findings that could be useful in legal disputes, such as in the Baltimore Beltway study of subdivision property where little or no damage was found from highway proximity.

Even when an appraiser does not have access to such economic impact studies, he impliedly uses similar information in his evaluation of a parcel. His experience and education become the basis for his expert opinion. Nevertheless, it is opinion testimony and, as such, it is subject to all the attacks inherent in the cross-examination of any opinion. Neither side to a legal dispute generally has adequate information to evaluate the trends, for the reasons of time and expense. It is hoped that economic impact and similar studies will fill this factual gap in case preparation. Mr. Watson Bowes, MAI, stated

³ The references cited by the italic numbers in parentheses are listed beginning on page 33.

this proposition in the following way: "Economic studies are not only advantageous in appraising highway right-of-ways but they are absolutely necessary. Every highway department appraiser employs such studies to some extent. Some appraisers relate economic studies to the subject properties by making only mental notes as they are developing their estimates of fair compensation. Such mental notes are difficult to transmit to juries and do not show on any appraisal report so they can be used as a negotiating tool by the negotiator" (9).

An operating official in the highway field of the State of Washington believes these studies serve: ". . . to provide data to staff and fee appraisers to assist them in more accurately measuring the just compensation in a partial taking problem. I believe that in all States the right-of-way divisions are finding that the constant improvement in appraisal techniques is resulting in more and more accuracy in the appraisal of a total taking, or in the before value of a property involving a partial taking" (10).

Right-of-way specialists generally are in favor of using such land value studies in appraisals as well as in court proceedings. Frank C. Balfour, Executive Vice Chairman of the American Right of Way Association; Rudolph Hess, Chief Right of Way Agent, California Division of Highways; Leonard I. Lindas, Chief Counsel, Oregon State Highway Department; Victor Eichhorn, Director of Right of Way Division, Michigan State Highway Department; and many State highway officials; and the Bureau of Public Roads have indicated their support of such research (11).

Land value studies of impact in an area that abuts a highway, compared with one for an area that is not near the highway improvement, would be particularly pertinent in court cases where land value trends are necessary factual background for the jury. It then would be possible for the court and jury to evaluate the work product of the expert appraiser against these data. The California Law Revision Commission (12) has seen fit to recommend the use of appraisal theory in condemnation cases in order to systematize the concepts of valuation and the background of testifiers. It usually is within the court's power to determine the rules of compensation, as a means of implementing a legislative decision, for the taking of a specific property subject to a public need.

In the main, empirical evidence at the trial consists of the appraiser's opinion of market value, as described in the following statement: An appraiser is supposed to reject elements that are remote, fanciful, speculative, and uncertain. In judging the situation the appraiser must determine whether the facts establish a diminution in value with reasonable certainty, as distinguished from merely hypothetical or fanciful assertions having no effect upon value (13).

Yet, in a world where statistical data are used to ascertain and provide decision-making tools to management and government, it would appear most proper to prove the appraiser's opinion of value by empirical or

statistical evidence. With the time-honored means of introducing appraisal opinion as expert testimony, the highway lawyers have avoided the use of much significant information, such as the various land value studies. The implications of these studies to evidentiary presentation will be discussed in a later part of this article that deals with the admissibility of research evidence in highway right-of-way litigation.

Interchange Impact

Right-of-way personnel have been especially interested in the subject of the impact of interchanges on land values: experience thus far has shown these interchanges to be the hubs of economic activity. Such impact studies at interchange points tend to provide data that can be utilized to indicate objectively the after value of property at such points. In the State of Washington, a number of case studies at interchange points have been prepared that may be used for such a purpose. In addition to this type of case study, general land value trends at interchange points are being established in the economic impact studies at the University of Washington, Texas A & M, and in the States of Michigan, Minnesota, Ohio, Oklahoma, Pennsylvania, and Washington, and many others where interchange impact on an area (general influence on land values) and on specific parcels can be delineated.

Severance Damage Studies

A major means of establishing property value is by use of the comparable parcel as the standard of value, so that the court and the jury may have the opportunity to approximate true value. To aid the court in this factfinding function, right-of-way personnel in State highway departments and private appraisers, through such professional organizations as the American Right of Way Association and various appraisal societies, have interested themselves in establishing various research programs in land values. By such land value studies an attempt is being made to supply the appraiser with knowledge of the economy in which he operates. The findings in such studies provide him, and other persons involved in right-of-way or eminent domain proceedings, with the reaction of land values in situations similar to the one involving the parcel in question. The important contribution made by this research is the aid that it may provide for valuing partial takes. Where whole parcels are acquired by condemnation, the establishment of market value is not as difficult as it is where only part of a parcel is acquired and the damages to the remainder must be evaluated.

Nature of severance damage studies

Severance damage studies are intended to facilitate the objective determination of the effect that the partial taking of a property has upon the value of the remainder parcel. Such information is invaluable if each affected property owner is to be reimbursed not only

for property taken but also for damages to the remainder.

To measure the effects of a partial taking of property, most severance damage studies rely on a before-and-after approach—the value of the property before the highway taking compared with the total amount that the owner received from the property; for example, for property taken, for damages to the remainder, and for the sale of the remainder. Ideally, the adjustment that should be made with a property owner is the difference in the fair market value of the entire tract before the taking, and the fair market value of the remaining real property after the taking. While the appraisal of these before-and-after values is made at the same time, the appraiser must attempt to determine the value as of two different times—one in the past before the highway, and the other in the future after the highway has been constructed and its influence felt. In those situations where the remainder is sold so that a reliable indication of the value of the remainder is provided, the elements for a meaningful comparison are available—the original value (determined by recognized appraising techniques) versus the value realized by the owner (total payments for property taken, for damages, and for remainder parcels). If there is wide discrepancy between these two amounts, either too much or too little is being paid for right-of-way property or damages; the legal limits to these rules are described later. Appendix V is a list of severance damage studies, completed or in progress.

Similarities Between Severance Damage and Economic Impact Studies

Severance damage or partial taking studies and economic impact studies have several similarities, and either type of study may sometimes be referred to generally as a land economic study. In fact, severance damage studies may be considered a particular type of economic impact study. For example, in a land value study now underway in Colorado, special emphasis is being given to the analysis of severance damages related to controlled-access highways. In general, severance damage studies and economic impact studies are alike in that the identification and measurement of effects that can be traced to highway improvements are sought. The careful attention given in both types of studies to measuring the impact of highways that have been built in the past results from a common objective—the development of a factual basis for predicting highway effects.

Some Contrasts Between Severance Damage and Economic Impact Studies

The differences between severance damage and economic impact studies result primarily from the identification sought for the different types of benefits. Both types of studies ordinarily consist of a comparison of the situation before and after the highway, to

determine the effect of the highway. Economic impact studies ordinarily are concerned with identification of benefits or disadvantages that accrue to an entire community or some portion of a community. General effects can be defined as injuries or benefits that the owner sustains or receives in common with the community generally and that are not peculiar to him (14). For example, the increment in land values that a community may experience from a bypass route would be termed a general benefit. The legal basis for these distinctions are described later in this article.

In severance damage studies, the concern is with highway effects on particular land parcels taken in part for highway property. If the total amount received by a property owner for right-of-way, for damage to the remainder, and from sale of the remainder exceeds the value of the property prior to the highway, a benefit has accrued to the owner. Often of great concern in severance damage studies are the special benefits—the highway effects that accrue to a particular land parcel taken in part for highway right-of-way—that are peculiar to a specific property and that are not shared by other properties in the community. Although the distinction between special and general benefits often becomes blurred, it is more common to look to special benefits than to general benefits in offsetting the damage suffered by remaining land parcels or in paying for property acquired in part.

Different approaches

Whether the focus of a study is on general or special benefits obviously affects the method used to identify these benefits. The case study approach commonly has been employed for severance damage studies. The experience of a highway-affected community with respect to land value trends, business volumes, or employment has been of more concern in the economic impact studies. The different types of control areas used in severance damage studies and in economic impact studies also reflect the different emphasis of these studies.

A fundamental type of analysis in economic impact studies, in which the detection and measurement of general benefits are sought, involves comparison of an area influenced by a highway and an area removed from highway influence. The ideal control area is one that is like the study area except that it has a complete absence of highway effect. The types of controls that have been used in severance damage studies show some variation; this, no doubt, has been caused primarily by differences in State laws as to which benefits can be considered in the establishment of compensation. In States where both general and special benefits can be applied against the cost of acquiring right-of-way property, a control area removed from the highway influence is desirable. However, in more than half the States where only special benefits are to be considered in the determination of adjustments to be made with affected property owners, control areas are needed in the immediate neighborhood of the

study parcel. A representation of how measurement of general and special benefits is sought by severance damage studies is included in appendix IV.

Shortage of Factual Information

The lack of systematically organized information poses a major problem in the evaluation of partial takings. The severance damage program of the Bureau of Public Roads and the State highway departments, for which an important goal is obtaining a basis for use in countering extravagant property damage claims with objective analysis, is expected to provide such information.

The difficulty of gaging highway effect without careful reference to the experience in comparable situations often has been illustrated. A severance damage study in Michigan, for example, revealed that a highway-influenced parcel of land, which was expected to have a value of only 5 percent of what it was worth prior to the highway, in fact, had an after value of 115 percent of its before value (15). In Ohio, researchers have noted that there has been no instance of an owner having had to sell a remainder parcel for as little as 10 percent of its former value, although estimates of 90-percent damages for landlocked property are reported to have become fairly common (16).

The dearth of factual information about what happens to remainder properties is widely recognized. One account of a typical appraisal states that it contains “. . . solid proof on the before value of the lands and improvements with full documentation . . .” and then the frustrating words, “. . . in my opinion the remainder is damaged 50 percent by reason of proximity” (9). Many appraisers are keenly aware of the fact that large scale right-of-way appraisal for highway improvements is relatively new, that it poses new problems, and that it intensifies the need for factual information as to how the market reacts to remaining portions, in order to make the after estimates something more than guesses from a crystal ball (17).

Accomplishments from Severance Damage Studies

The goal for severance damage studies—to make it possible to predict at the time of right-of-way taking what effect the highway will have on the remaining parcel—appears to be almost insurmountable. Any two or more properties obviously vary to some degree so that predictions of what may happen to one piece of property, on the basis of the experience with other properties, can be only approximate and must be made with considerable caution. The difficult nature of this problem is emphasized by the wide variation in the experience with remainder parcels; the unit value of remainder parcels in one study ranged from one-half to nearly 15 times the former value (18).

While exact evaluation of benefits and damages associated with right-of-way taking is desirable, real benefit can be derived from

severance damage studies that are short of such precision. This is evidenced by the usefulness of current studies for such purposes as right-of-way acquisition, public relations, highway planning, and administration. In instances where benefits associated with a highway right-of-way taking exceed the value of property taken, it may be sufficient merely to determine that benefits exceed or equal the value of the property taken; benefits ordinarily cannot be offset unless they are matched by the value of right-of-way acquired or by damages, as described later in the legal analyses. Determination of the exact amount would appear to be necessary only where the benefit is insufficient to offset costs—in situations where the amount of the award due an owner exceeds any benefits that may be allowed and, therefore, where the amount of the award payable depends upon the establishment of amounts for benefits or for any damages. Consideration of benefits associated with partial takings, without the assignment of exact benefit amounts, apparently can be of some usefulness in those situations where no attention whatsoever is now being paid to this important element of the post-highway situation. In such cases, recognition of any highway benefits should be helpful in establishing more reasonable costs for right-of-way acquisition.

Market approach

Partial taking studies in which benefits merely are recognized or estimated in a general way—the benefits approach—have considerable usefulness. However, in a number of studies the scope has been increased and a market approach applied—a measure of effect determined by the market place. These studies have provided information for comparisons of estimated and actual highway effects on remainder parcels, and some of these estimates have been shown to be fairly accurate. In several instances, estimated and actual damages, generally established by actual sales prices, have been found to be within a few percentage points of one another; for example, estimated damages of 13 percent and actual damages of 7 percent; estimated damages of 37 percent and actual damages of 27 percent; and estimated damages of 80 percent and actual damages of 70 percent (19).

The progress made in these studies in evaluating the effect of certain factors, such as having more than one potential purchaser for certain types of remainder parcels, should be of general usefulness in determining what may happen to remainder parcels. As might be expected, the selling price of landlocked parcels with two or more potential buyers has been found to be significantly higher than that for remainder properties with only one potential buyer; that is, one abutting owner. Certain parcels in Ohio with one abutting owner were found to have a percentage of recovery of 20 percent (that is, the selling price in the after period was 20 percent of the appraised value before the highway), while parcels with two or more abutting owners had a recovery rate of about 80 percent (20). In Michigan,

recovery rates for parcels with one potential buyer were found to range from 32 to 57 percent of the former value and from 90 to 113 percent for remainder parcels with two or more possible purchasers (15).

Research in partial taking studies also has provided assistance in forecasting highway effects by relating experience with remainder parcels to such factors as size of remaining parcel, size of farm unit before the severance, and type of potential purchase. For example, the degree of damage sustained by a 160-acre farm from the loss of 5 to 10 acres is less than that experienced by an 80 acre farm from a similar loss. In at least one investigation, small remainder parcels were shown to have a lower rate of recovery than larger parcels, although preliminary findings from another investigation showed no apparent correlation (19).

The preceding discussion indicates the help that these severance damage studies can afford by providing authoritative proof of just what can be expected to happen to the value of the remainder parcel of land. Another accomplishment obtained from these studies is a sign that progress is being made in the objective determination of highway effects. This is indicated by the apparent increase in the expectation that appraisals of after values are to be supported by specific written justification, and the need for adequately supported appraisals.

Collection of Data on Severed Parcels

To develop a file or bank of cases from which information on comparable sales experience for severed parcels may be obtained, the Bureau of Public Roads and State highway departments are sponsoring the use of a standardized study procedure, which encompasses a manual of procedures and suggested techniques. Use of this instructional material will make published results and methods available to highway departments; this information can be helpful in solving controversies on valuation. The necessity for such a bank of information exists because experts, appraisers, and others valuing property generally do so in terms of whole parcels; real estate valuation experience is most prevalent in the area of whole parcels. Little analyzed data are available for use in determining the experience with severed parcels or partial takes. This bank will furnish the means for developing comparable sales information for severed parcels, according to the procedures designated by the manual for obtaining this factual information. The manual also provides suggestions for obtaining maximum usefulness from a uniform severance damage form, which has been developed by the cooperative efforts of interested persons in the various States, the American Right of Way Association, and the Bureau of Public Roads.

The recommended procedures for using the severance damage data include a description of the way in which severance damage data are to be collected and processed, and a brief description of the types of analyses that will be feasible for mechanizing the recording and sorting of these data. It is hoped that a

central bank of information regarding similar severed parcels will be available at the Bureau of Public Roads for the use of State officials. With the mechanical sorting devices to be used, it will become possible to make comparable sales information available to researchers and appraisers in the field.

The uniform schedule form used (PR 1030) requests the following data: General information on parcel location, type of highway, and type of access; description of tract, parcel taken, and remainder tract; relevant data on taking, size and use of parcel, zoning, visibility, elevation, appraisal value, compensation, court awards, and subsequent sales. All of the elements of information requested on this form are relevant to the establishment of parcel comparability and market value. The details requested on these forms should make it possible to narrow down the comparabilities so that the evaluation of the parcels may be comprehensible to factfinding bodies.

Because of the systematic nature of the collection of severance damage cases, it is expected that comparable sales information will be made available readily and that courtroom presentation will be facilitated. The comparability still will need to be proved and still will be subject to dispute, but standardization of procedure may eventually determine the use of these bank cases in all States.

Evidence for Offsets

These severance damage studies and case histories of individual severed parcels also will be used to indicate the amount of benefits as offsets to damages and the value of property taken in cases where such offsets are permitted. Where benefits may be offset, difficulty usually is encountered in establishing the amount of general or special benefits. Use of these bank cases also is expected to make it possible for appraisers to estimate the amount of benefits; estimates based on elements that historically have been associated with similar cases.

Despite the case histories that will be made available from these studies, the usual objection is expected to be that the amount of offset to damages, if any, found in such studies does not apply to the parcel under consideration because the studies represent property that is different in nature, type, location, etc., from the property under litigation. In the case of the severed parcels, it is hoped that the histories of land parcels of similar types, as valued through market sales, will be indicative of the value of the parcel in question. The utilization of land value studies in court work generally will be objected to on the grounds that, as averages, the studies represent a dispersion of properties, that they deal with hearsay, and that they do not represent the property involved. In the next two sections of this article, the current status of the law of proof, and the possibilities of meeting the hearsay and other objections are discussed. These discussions point the way toward more effective utilization of such economic studies in the courts, and they also point out the limitations to the use of such studies.

PERTINENT LAWS OF EMINENT DOMAIN AND EVIDENCE

Introduction

The possible uses of economic evidence in highway condemnation litigation must be considered in light of the pertinent law of eminent domain and evidence, and in light of the problems involved in applying this law. With this objective, the following points are examined: (1) The nature of the condemning authority's duty to compensate those whose property it takes. (2) The rules and criteria of value whereby this compensation is measured, particularly where only part of a tract of real estate is taken for highway purposes. (3) The types of permissible evidence currently used to prove the property value, damages, and benefits designated by these rules and criteria of value as components of the property owner's just compensation.

In this examination of the current law, how the types of economic evidence heretofore discussed would meet existing inadequacies and thereby facilitate a more accurate measurement of the property owner's just compensation are considered, as well as how these types of economic evidence would comply with the rules of evidence. The potential challenges raised by the rules of evidence to the admissibility of this economic evidence are discussed in another section of this article.

Constitutional Provisions for Just Compensation

Fundamental to the law of eminent domain in the United States and in the several States are the Federal constitutional provisions (21) that require just compensation to be paid to owners of private property taken pursuant to the power of eminent domain. These Federal provisions and a majority of the State constitutions (appendix I, part A) require only that such compensation be made to the owner of property taken by eminent domain, but some State constitutions (appendix I, part B) extend the right of just compensation to owners of property damaged by the exercise of eminent domain. Taking, in the constitutional sense, entails either actually entering on the land or depriving the owner of substantially all beneficial use of the property (22). Damaging, in the constitutional sense, occurs when noncondemned land either has sustained an injury actionable at common law or has been injured more than the general public by the physical disturbance of one of the owner's rights therein (23). Compensation for taking is measured by the property's value at the time of taking, as defined (24); compensation for damaging is measured by the value depreciation of the damaged property (25). Thus, the exercise of the eminent domain power requires ascertaining in every instance the value of the property taken and, in some instances, both the value of the property taken and the value depreciation of property not taken.

Value Criteria for Measuring Just Compensation

The judiciary, whose exclusive function it is to determine the exact amount of compensation in each case, has largely formulated the rules and criteria of evaluation in eminent domain cases. Courts generally have held the just compensation constitutionally required for the taking of property to be the property's value at the time of the taking (26). This value has been further defined, in most cases, as the property's market value (27); but where market value has not been reasonably ascertainable, courts have had recourse to what they term the actual or intrinsic value of the property (28).

The concept of market value (29), especially as applied to real estate, does not readily admit of concise and practical definition. The practical application of this concept in condemnation proceedings has led to the generally accepted definition of market value as: The amount of money that a purchaser willing but not obliged to buy the property would pay to an owner willing but not obliged to sell it, taking into consideration all uses for which the land was adapted and that might in reason be applied (30).

The constitutional requirement of just compensation for taking, from which stems the market value criterion, implies full indemnity to the owner (31). However, this indemnification extends only to the value of the property taken and does not guarantee that the owner will receive a return for his investment in the land (32). For purposes of establishing market value, the land is looked upon merely as so much land and apart from its sentimental value to the owner or his willingness or unwillingness to sell it (33).

Market value criterion

Under the market value criterion for establishing just compensation, all the elements of value that contribute to the saleable character of the land are relevant; that is, all the facts that an owner would naturally and properly press upon a prospective buyer's attention, and that naturally would influence an ordinarily prudent person desiring to purchase (24). Thus, the owner of condemned land is entitled to have it evaluated in light of the highest and best use to which the land can reasonably be adapted, irrespective of its current use or the owner's immediate plans for its use (35). However, only the highest and best uses legally permissible are those that are not remote or speculative and that would affect the present market value of the land (36).

The market value criterion has been bypassed in certain types of cases. The condemned land may have been improved and adapted for such a special usage as not to be readily saleable at anything near its real value (37) or other circumstances may preclude the ascertainment of market value (38). The landowner's constitutional right to full indemnity for the loss has led courts, under these circumstances, to adopt the intrinsic value or value-to-the-owner criterion (39).

Under this criterion, the objective value of the property, to the owner or to anyone else for any special use to which it has been adapted, is considered (40). It is frequently arrived at by calculating the replacement cost of the improvements on the land, less depreciation, plus the value of the land (41).

Only the value of the property taken is to be indemnified under the just compensation for taking provisions of the Federal and State constitutions. Thus, the value of the buildings and fixtures thereon are properly compensable (42). However, any business operated on such property, including any goodwill appurtenant thereto and any anticipated profits therefrom, is not considered a property right within the meaning of these constitutional provisions (43). The courts have reasoned that the business is severable and distinct from the land; only where the business is taken over by the condemning authority will the owner be compensated for the value of the business (44). The impact of this rule has been alleviated in many States. In some, special legislation authorizes compensation for the taking or damaging of a business by eminent domain (45). In others, the courts have admitted the profits of a going business concern on condemned property as evidence of its value for its highest and best use (46). The restricted scope of this indemnification also precludes compensation for the frustration of contracts related to the condemned property (47) and for the inconvenience and expense incident to being dispossessed of the property (48).

Modifications in Partial Taking Cases

Computing just compensation for the condemnation of only a part of a tract of land raises a new series of valuation problems. Even under a mere taking provision, the owner of a tract of land is not confined to recovery of the value of the land taken. Besides any increased value that may inhere in the land taken because it is part of a larger tract (49), the owner of such a partially condemned tract further is entitled to recover any severance damage to the remainder (50). These severance damages include the correlative loss of any value that may have inhaled in the remainder as part of the larger tract (51). They further include any present or prospective depreciation in the remainder's market value that naturally and proximately results from the proposed use of the condemned part. Any aspect of the proposed use that may detrimentally influence a prospective purchaser of the remainder property is considered in ascertaining these damages (52). Severance damage studies, insofar as they trace the subsequent market-value history of land severed for highway construction, are especially designed to be of assistance in the computation of severance damages.

Setoff of benefits

Integrated with the assessment of severance damages are the various rules governing the setoff of benefits accruing to the remainder parcel from the prospective use for which the

land has been condemned. The benefits that frequently accrue from a public improvement to neighboring lands are often the subject of a special assessment on the neighboring land thereby benefited (53). Such assessments, which serve to defray or cover the cost of the public improvement, are a proper exercise of the power of taxation (54). In most jurisdictions, with various limitations hereinafter discussed, the same type of benefits are considered in computing the compensation due a landowner for land partially taken by eminent domain. Accordingly, prospective benefits, which will enhance the market value of land from which condemned land has been severed and that are attributable to the particular public improvement for which the condemnation has been made (55), have been setoff against the compensation to which the landowner would otherwise be entitled.

Benefits have been classified as either special or general. Special benefits accrue in a peculiar way to a particular tract because of its direct relation to the public improvement. Conversely, general benefits accrue to the general public of the community as well as to directly related lands. In highway condemnation cases, courts usually have distinguished between these two types of benefits on the basis of whether they accrue only to lands abutting the highway or to nonabutting lands as well (56). Thus benefits that accrue to nearby lands, which do not abut the highway, are regarded as general benefits (57). However, benefits accruing to abutting lands, including land of which no part has been taken and land that has been partially condemned, are regarded as special benefits (58). Severance damage studies, which analyze the market value development of highway severed remainder parcels, have been designed to assist in the determination and measurement of special and general benefits. With respect to general benefits, however, a similar service may be provided by other economic impact studies, which analyze the market value development of communities affected by highway development.

Both general and special benefits may be setoff in some States, but only special benefits are deductible in a majority of States, as shown in Parts A and C of appendix II. Setoff of both types has been held perfectly consistent with the property owner's right of full indemnification and, accordingly, has been constitutionally sanctioned (59). Historically, setoff has been justified as an exercise of the power of taxation (60). Setoff of general benefits has been disallowed primarily for two reasons. Such setoff has been regarded as an unjustly exacted payment from the owner of partially condemned property for benefits equally enjoyed by his neighbors without charge (61), and general benefits also have been regarded as too speculative to be assessable as compensation (62).

Rules of setoff

The rules of setoff further differ as to the elements of compensation from which benefits may be deducted. Except in two States, benefits are setoff against severance damages

to the remainder, as shown in appendix II. Under this rule, benefits are regarded as one of the elements enhancing the property's market value, only the depreciation of market value is compensable (63). On the other hand, several States prohibit the setoff of benefits against the value of the property taken; these States are identified in appendix II. A primary requirement of many of these State constitutions is that just compensation be made in money, which precludes setoff against the value of the land taken (64). Conversely, where setoff against the full compensation is allowed, it is regarded as the only just allocation of cost between the public treasury and the private property owner (65).

Thus, in cases where part of a tract of land is taken by eminent domain, determination of the landowner's just compensation will be affected by the rules of setoff in any one of five different ways, depending on the local law: (1) General and special benefits may be setoff against both the value of the land taken and the severance damages to the remainder; (2) general and special benefits may be setoff only against the severance damages; (3) only special benefits may be setoff against the value of the land taken and the severance damages; (4) only special benefits may be setoff against the severance damages; or (5) no benefits of any kind may be setoff. Refer to appendix II for information on setoff rules. The cost of highway right-of-way acquisition, which necessarily involves much partial taking, is substantially affected by whichever setoff rule applies. This is illustrated by the varying amounts payable in a hypothetical situation shown in table 1, in which the original value of the property was \$200,000.

Formulas for Computing Just Compensation

The several considerations incident to ascertaining the condemnee's just compensation in partial taking cases have resulted in two judicially created rules. Under the before-and-after method, the condemnation tribunal always appraises, according to the same principles heretofore discussed, the value of the entire tract of land before the partial taking (66). Then, if no benefits are to be setoff, it appraises the remainder without regard to any

expected benefits (67). However, if any benefits can be considered, the remainder is appraised in light of those anticipated benefits that properly can be setoff (68). The inherent shortcoming in use of this formula lies in the inability to segregate the value of the part taken from the value of severance damages to the remainder. For this reason, it would seem inadequate where benefits are to be setoff only against severance damages. Although the before value may be shown by comparable sales of similar property, the very nature of the severed remainder, which abuts the highway after the taking, may severely limit the availability of comparable sales evidence of the after value. However, severance damage studies, through the classification and compilation of the sales of similarly severed parcels, would provide such needed comparable sales evidence.

Value-plus-damages formula

As an alternative, the value-plus-damages formula provides a much more complex but theoretically precise method of computing the condemnee's award in partial taking cases. Under this formula, the value of the part taken is appraised separately (69); then the severance damages to the remainder are determined either as a separate sum (70) or in light of the benefits properly setoff (71). Where the damages have been separately computed, any permissible setoff benefits are assessed (72). Then, the final award is computed by subtracting all properly setoff and properly assessed benefits (73) from the sum of the value of the land taken and the severance damages or, as determined by local law, only from the severance damages. Severance damage studies, by focusing on the subsequent history of severed parcels, are especially geared to provide reliable indices on severed remainders for both the damages and benefits resulting from highway takings.

In a comparative appraisal, each of these formulas appears to have its own distinctive merits. Only the value-plus-damages rule recognizes and theoretically complies with the condemnee's constitutional and statutory rights to be compensated in money for land taken. However, the artificial and complex division of this formula make it inherently difficult to apply. Under it, the same element of damage may be assessed in duplicate under

different theoretical guises (74). On the other hand, the before-and-after rule stands out for its simplicity of application and its inherent capacity to reflect the value of the land taken and the severance damages. As noted, the main drawback to use of this rule is the inability to segregate the value of land taken from severance damages, in order to assure compensation in money for the former.

PROOF OF VALUE

Applicability of the Rules of Evidence

The concepts of value relating to just compensation and the formulas integrating them can be effectuated only insofar as the rules of evidence permit. Each time the power of eminent domain is exercised to take private property, the *quantum* of the owner's just compensation must be determined by an arbiter of the facts. State constitutions and statutes variously provide for this function to be performed by either a board of commissioners (75) or a common law jury (76). The board of commissioners, chosen for its peculiar skill and knowledge in property valuation, generally is not bound by the rules of evidence (77). Rather, its members are simply charged to appraise, impartially and to the best of their skill and knowledge, according to the substantive rules of valuation (78). In contrast, the common law jury, not chosen for any special knowledge or skill, is for the most part bound by rules of evidence (79). Hence, in proof of the condemned property's value, the rules of evidence exclude from the jury's consideration any evidence that is not both competent in itself and material and relevant to this issue (80). Severance damage studies, by the very nature of their subject matter, ought to be found both material and relevant to the issue of market value in partial taking cases; the evidentiary status of these studies might be challenged on the basis of competency. However, as hereinafter discussed, properly conducted severance damage studies ought to be found sufficiently competent to be admitted as an exception to the hearsay rule, which is discussed in connection with the admissibility and use of research evidence.

The Objective of Market Value Evidence

Within the scope of these rules, certain types of evidence are commonly and strategically used in proving the market value of condemned property. Market value is not simply an inherent quality of the property; it is largely a reflection of the state of mind of the public with respect to that property (81). This state of mind commonly is proved by the opinions of qualified witnesses, who testify as to what value they estimate the public would attach to the particular property taken or damaged by eminent domain. This state of mind also is frequently proved by deduction from the prices paid in recent sales for the same or similar property, which are admitted

Table 1.—Example of variation of compensation for property according to provisions for offsetting benefits against damages

L=\$80,000=value of land taken.		Bs=\$40,000=special benefit.
S=\$20,000=severance damage to the remainder.		Bg=\$50,000=general benefit.
Prevailing rule	Calculation	Compensation due owner
1. In some States, both special and general benefits can be used to offset both land cost and severance damage.	$(L+S) - (Bs+Bg)$	\$10,000
2. In some States, both special and general benefits can be used to offset severance damage only.	$L + [S - (Bs+Bg)]$	80,000
3. In some States, special benefits only can be used to offset both land cost and severance damage.	$(L+S) - Bs$	60,000
4. In a number of States, special benefits only can be used to offset severance damage only.	$L + (S - Bs)$	80,000
5. In two States, no offset of benefits is permitted.....	$L+S$	100,000

as evidence of the market value. By virtue of the index of this state of the public mind, which the severance damage studies have been designed to provide, these studies ought to implement opinion testimony on the market value issue and provide a broader scope of sales evidence.

Evidence of Other Sales

Actual sales of the condemned property not too remote from the valuation date, when the property has been voluntarily bargained for in good faith, are admissible evidence of the property's market value (82). Presentation of this type of evidence is most strategic. Any prospective purchaser of land is bound to be influenced by the price recently paid for it in a voluntary and bona fide sale. The jury seeking to indemnify a property owner for his loss, naturally, is influenced by any price recently paid by him for the property. The mere fact that it is the same property precludes many of the distracting collateral issues that otherwise would arise (83). Nevertheless, such evidence is not conclusive of the property's value at the time of taking (84).

In contrast to evidence of recent sales of the condemned property, evidence of recent sales of property similar to the condemned land usually is more readily available but less readily admissible. Although evidence of such sales is universally admissible to cross-examine opinion testimony (85), only a minority of four States now prohibits its use as direct evidence of market value. Refer to appendix III for more information. However, the law of the majority of States favors the soundness of admitting such sales as direct evidence of market value. Thirty States expressly allow such sales as independent evidence of market value; those of the remaining States, whose courts have considered this kind of evidence, all tend to give it some affirmative probative value, and recently, in a noticeable changeover, a number of former minority States have adopted the majority rule (86).

Very cogent reasons support the admissibility of such sales, either as independent evidence of market value or in support of opinion testimony. Market value, the criterion of just compensation, is the price at which property sells in the open market. When made under normal and fair conditions, such sales are by their very nature a more valid indication of market value than the speculative opinions of witnesses (87). Thus, when offered in support of such testimony, sales evidence enhances the testimony and, when offered as independent evidence, provides a firm basis for any condemnation award for which other kinds of evidence may be ignored. Severance damage studies, insofar as they are based on comparable sales of severed parcels, ought to be accorded equally strong probative value.

Inherent drawback

The inherent drawback to use of recent sales of similar property as evidence is the multitude of collateral issues that each such sale raises.

For each such sale proffered in evidence, the court often decides as preliminary questions of fact the numerous issues of comparability, proximity, and voluntariness, hereinafter discussed. Furthermore, for each such sale admitted in evidence, the jury must decide wherein and to what extent the recently sold parcel differs from the condemned parcel and must make allowance for such differences in arriving at the latter's value (88). The multitude of these collateral issues by their digressive effect, especially when multiplied by the number of comparable sales introduced, may substantially impede the valuation procedure. For this reason, the number of comparable sales admissible in any one case may be regulated by the court (89). As heretofore discussed, the admission of statistical surveys would require the court to determine, as a preliminary question of fact, whether the proper methodology had been followed in conducting the survey to establish its reliability as evidence. However, once this collateral issue had been resolved, a much broader scope of comparable sales evidence would be available to the jury.

Restrictions

Certain requirements of similarity and proximity restrict the admission of all sales of similar property. The property sold must be sufficiently similar in character and geographically proximate to the condemned property to be useful in reflecting the latter's market value (90). The exact degree of each qualification required in each case is determined largely by the trial court within its discretionary power (90). However, certain elements of similarity are almost universally demanded by the courts. Where nearness to schools, churches, transportation, and shopping centers substantially influences the value of property, only sales of property located a similar distance from these public facilities may be admissible as comparable (91). Where the highest and best use of a tract of land is for agricultural purposes, sales of more distant property with soil of a similar character may be deemed sufficiently similar to be admissible (92).

Where the condemned property has been adaptable for such a special highest and best use that sales of similarly adaptable property in the same community were not available, the requirement of geographical proximity has been largely abrogated (93). For the same reason, the market value of severed lands with a special highest and best use because of their adjacency and access to a major highway ought to be provable by the sales price of a comparable remainder in another community. Similarity in the topographical features, size, and shape of the two parcels also ought to be considered (94). If the individual sales compiled in severance damage studies were to be introduced in evidence, each such sale would be subjected to these same tests of comparability. However, if a survey of such sales made in a severance damage study were to be admitted in aggregate form, the comparability of the sales included would be shown by an exam-

ination of the methodology and criteria used by those who conducted the survey.

Timeliness

Furthermore, to be admissible as evidence, sales of similar land must be so proximate in time to the date when the condemned property was taken as to furnish an indication of value at the latter date (95). The permissible interval depends partly on the stability of market conditions and the availability of more recent sales but ultimately, in each case, it is determinable by the court within its broad discretionary power (95). The timeliness of sales included in severance damage study surveys easily could be shown by the survey director's testimony.

Both recent sales of the condemned property and recent sales of similar property, in order to be admissible, must have been voluntary and the property bargained for in good faith (96). The requirement of voluntariness precludes admission of evidence of sales wherein either party acted under any coercion. Thus, where the threat of condemnation or the need to sell out or purchase with undue haste has induced either party to consummate a sale, such a sale is not admissible evidence (97). On this basis, a majority of the States exclude all sales to a condemnor or purchaser with the power of eminent domain (96). To assure that such sales evidence reflects market value, only such sales as were bargained in good faith by both parties are admissible (76). Thus, only sales made by parties capable and desirous of protecting their own interests are admissible. The voluntary and good faith nature of sales included in severance damage studies is one of the facts ascertained by those who conduct such studies. Thus, the exact degree of voluntariness and good faith common to all such sales included in any survey introduced in evidence could be ascertained by examining those who conducted the survey.

Evaluating sales evidence

When a sale of similar property has been ruled admissible, it is merely deemed sufficiently similar to be helpful in evaluating the condemned property. Both parties are then entitled to introduce evidence of the differences between the two properties to show wherein and to what extent the condemned property's value is greater or lesser (99). A severance damage study survey, when ruled admissible, also might be shown on examination of the study director to have been based partially on dissimilar sales. Thus, the admission in evidence of such a survey would not preclude either party from showing wherein the condemned property's value should not be governed by the survey. However, severance damage studies by the breadth of their scope would weigh heavily against any speculative valuation of the condemned property.

When such sales are admitted as independent evidence of value, the sales price must be proven with as much formality as other material facts. Thus, those considered competent

to testify to the prices paid in such sales are persons who were parties or brokers to such sales or who in some other manner knew of the price paid of their own knowledge (100). Accordingly, the mere recital of consideration in a deed and other hearsay sources of price information are not admissible (101). However, the Federal revenue stamps affixed to real estate deeds have been admitted as evidence of the amount of consideration (102). Thus, the sales price information collected in severance damage studies would be reliable and, therefore, competent evidence so long as, in the conduct of the study, this information was taken either from interviews with parties to the transactions or, in some States, from the Federal revenue stamps on the deeds.

Opinion Evidence

Historically, market value has been regarded by the courts as merely a matter of opinion (103). To assist the condemnation jury in forming its opinion of the market value of property taken or damaged by the exercise of eminent domain, the opinion testimony of those with special knowledge relating to the property's value is admissible evidence (104). Such opinion evidence, however, is merely advisory and, accordingly, not binding on the jury (105).

Consistent with the rationale for the admissibility of all opinion testimony, such opinions may be given only by those possessed of some special knowledge or skill deemed valuable to the jury in forming its conclusion (106). In condemnation proceedings, real estate experts are considered competent everywhere to give opinion testimony on the property's market value (107), and in some States neighboring residents and businessmen also are considered competent to so testify (108). Moreover, in addition to their respective special knowledge or skills, all condemnation value opinion witnesses must possess certain factual knowledge. All must be both personally acquainted with the condemned property and personally familiar with the state of the market in that area (109).

Those who have bought and sold, valued, or managed real estate in the community are deemed to have acquired therefrom such skill in appraisal and such knowledge of property values as to be real estate experts competent to give opinion testimony (107). Such experts also must have a personal knowledge of the condemned property and market conditions in the area. Accordingly, they must base their testimony on characteristics and conditions that they actually have observed rather than on hypothetical conditions (110). Only in the absence of a market value are specialized experts competent to give opinion testimony regarding the property's intrinsic value (111). Real estate expert testimony has been regarded as the most practical medium of presenting to the jury the appraisal hypotheses on which either party seeks to have the condemnation award based (112). Both severance damage studies and other economic impact studies would provide a means of testing such a witness's expertise in appraising property affected by a highway.

Lay witnesses

In a majority of jurisdictions, neighboring residents and businessmen are deemed competent to give opinion testimony (113). This competence is premised on the special familiarity with local real estate values that they are presumed to have acquired by their long-standing activity and interest in the area (114). Such lay witnesses are not deemed to possess any special appraisal skill; rather, it is their special familiarity with local values that qualifies them to give value opinion testimony (115).

The speculative nature of such testimony perhaps is best illustrated by a recent Missouri highway condemnation case (116) in which the only opinion witnesses on value were two neighboring farmers. An award of \$400 was determined by commissioners. Both parties appealed to the circuit court for a jury trial. On the before-and-after basis, one farmer's testimony would have warranted an award of \$4,725, and the other's testimony, an award of \$2,500. Apparently influenced by these lay witnesses, the jury awarded \$2,000. Where no real estate experts who are familiar with the condemned property and values in its surrounding area are available, use of such lay witnesses may be the only available means of proving value. In such a situation, severance damage studies ought to provide both a ready selection of sales of comparably severed parcels and a more reliable index of the remainder's value through survey evidence. Furthermore, economic impact studies relating to the area of the condemned property might be used to cross-examine the lay witness on his knowledge of local real estate values.

Owners' opinions

The owner of the condemned property is deemed competent to give his opinion of the property's value by virtue of the knowledge that he is presumed to have as owner (117). Although this type of testimony is competent as a matter of law, the condemnee's natural bias has been said to derogate from the weight that a jury would otherwise accord to it. For this reason, it has been suggested that such testimony serves little more than to enable the owner to personally present his claim to the jury (118). Cross-examination on the basis of severance damage studies ought to both substantiate reasonable claims expressed in testimony by such an owner and delineate the true nature of any speculative claims proffered by him.

All opinion testimony on the condemned property's value must be based on the substantive rules of valuation heretofore discussed (119). In support of his opinion, on direct examination, the condemnation value witness should give the facts on which the valuation is based (120). These facts indicate the extent of the witness's familiarity with the condemned property. This familiarity naturally affects the weight that the jury will accord to the testimony. Such supporting evidence has been held indispensable to sustain the opinion (121). The reasons or general principles on which the opinion is based also may be given on direct

examination (122), even though they are frequently left to be extracted on cross-examination. Severance damage study surveys and other economic impact studies should be of help by providing facts that can be relied upon by the expert opinion witness.

Supporting data

The supporting data to which the opinion witness testifies must be relevant and competent (123). Thus, with few exceptions, the opinion witness can testify on direct examination only to such data as would be admissible as independent evidence. Even though not admissible as independent evidence, in some jurisdictions comparable sales are admissible in support of opinion testimony on market value, as shown in appendix III. However, the hearsay rule has been somewhat relaxed in its application to the supporting data offered by expert opinion witnesses (124). The Oregon Supreme Court seems to have fashioned another exception to the hearsay rule; it has held that a real estate appraiser may properly introduce, as supporting evidence for his expert opinion, reports made by other investigators that he deems reliable (125). Other courts have indicated a similar inclination (126). Severance damage studies and other economic impact studies would seem to qualify under such a hearsay exception. The need for hearsay exception to allow the use of these studies as evidence is discussed in the next section of this article.

ANALOGIES TO OTHER FIELDS OF LAW

The need for improvement in means for determining fair compensation for land taken for highways has been described. The rapid changes in evidentiary practice occurring in other fields of law have not extended to the conventional rules governing the admissibility of evidence in condemnation cases involving land acquisition, particularly for highway right-of-way. Avoidance of the use of many types of economic facts in highway condemnation proceedings has been cited; particularly noted were some cases in which the courts' decisions were required as to valuations for remainders in partial takings, evaluation of benefits or damages resulting therefrom, and/or predictions of possibilities and probabilities of the effects of partial takings on remainders. Ways and means of ascertaining the answers for the problems posed, and related problems, heretofore have not been available. The difficulties engendered in obtaining the admission of economic research evidence in highway cases probably have resulted either from a lack or a shortage of economic factual data with which to make and support land valuations. A simplification and liberalization of the present exclusionary rules is needed; this would permit the use of economic research evidence and thereby allow more extensive reference to, and reliance on, data obtained by land economic studies, statistical surveys, samples, and opinion polls. Such data would serve as aids to the courts for ascertaining the economic facts relevant to the determination of land valuations.

Recognition of Research Evidence

Despite the frequent exclusion of research evidence as a device for evaluating land in condemnation proceedings, judicial recognition and acceptance of certain types of research evidence have occurred in various areas of litigation that may be applicable to eminent domain cases. Statistical data, summarized in census and other reports, and mortality and annuity tables are judicially noticed and at times have been admitted into evidence without a showing of the trustworthiness of the report or table. Various fields of commercial law, both private and public, have resorted to the findings of economic research. Market reports and price lists are admitted as evidence for the determination of the value of personal property. Authoritative works of scholarship, traffic surveys, and socio-economic data are admitted into the courts as independent evidence.

In this section, it is the intention to point the way toward the admission of similar research evidence in condemnation proceedings. "Law is a progressive thing. It is an expansive thing, adapting itself to new relations and interests of men. They are constantly springing up in the progress of society. But this progress must be by analogy to what is already settled" (127). Analogy, then, is the key-stone of this section. If economic data can be admitted in the form of census reports and statistical tables and used as a yardstick for determining the value of personal property, these data should be usable as independent evidence and as circumstantial evidence, where necessary, on which the expert can rely in determining land valuations.

The emphasis here, therefore, is to present the state of the law and practice in the admission and use of research evidence in various types of cases, and to advocate the use of economic research evidence in condemnation proceedings.

Previously, the applicability of various kinds of evidence in condemnation proceedings was discussed. Parallel to a study of this nature are: (1) A consideration of the best methods of preparation and presentation of research evidence. (2) A formulation of standards to guide lawyers and courts in the presentation of economic research findings of various kinds. (3) An analysis, where economic research is germane, of widely differing situations and their classifications. (4) The limits on admissibility of economic research in courts of law. These various points will be referred to only indirectly as they are not the principal subject of this study.

Objectives

The doctrines of evidence, their applications, and the decisions stating them are as numerous as the sands of the sea. Therefore, the treatment here on the admissibility of research evidence is highly selective and demonstrative, with no pretensions to completeness. The objective is to furnish the appraiser and the lawyer with a starting point for improving measures of determining land values, so that the landowner whose property is taken or damaged will receive fair compensation. The

admission of the results of economic research is one direction in which improvement may be made. Hence, a study of the use of economic research evidence in the areas of law where it is accepted and an understanding of its application are indispensable to those recommending its use in condemnation proceedings.

Admissibility and Use of Research Evidence

Factfinding is the pillar on which all judicial applications of law depend (128). Ascertaining facts is not always limited to the determination of facts and circumstances within the knowledge of a relatively small group, namely, the parties to the action and their supporting witnesses. Frequently, complex issues in dispute compel recourse to an almost boundless group from which information is collected, analyzed, and summarized in order to make generalizations, which are reflected in statistical tables or series. Whether this type of factual statistical data is hearsay (129) and, if so, whether necessity or practical convenience provides sufficient justification for excepting it to the tenets of the hearsay rule is a matter begging judicial decision.

Admission or refusal of such hearsay data (or the acceptance of some hearsay evidence and rejection of some) is based on judicial recognition that hearsay is not all more or less alike or amenable to being dealt with in a simple or uniform manner. There are many types of hearsay evidence (130); they are as numerous and as variegated as the types of communication, ranging from third-stage rumors to sworn affidavits of credible observers (131). Correspondingly, the trustworthiness of hearsay evidence scales from utter worthlessness to the highest reliability and depends upon the human frailties of perception, memory, and veracity. Such recognition concedes that evidence is not taboo merely because of its hearsay nature, but that recognition of hearsay evidence and its admission depends on the court's determination of its reliability.

Statistical data accepted as evidence

Only two types of statistical or survey data are unquestionably admitted as independent evidence for the truth of the matter asserted therein (132). These two surveys are the U.S. Census reports, samples as well as complete enumerations (133), and mortality tables used in the computation of annuities, life insurance sums, dower, and damages for loss of life (134). In addition to their admission into evidence, they also may be, and frequently are, judicially noticed by the court (135), with all evidence to prove the facts contained therein being dispensed with. Even if admitted into evidence, the party proffering them usually is not required to make a preliminary showing as to their source, methods of compilation, authenticity, or reliability (136).

The courts have explained that census reports have a status of admissibility, which is withheld from other research reports, because of: (1) The confidence commanded by the

disinterested manner in which census reports are compiled, (2) the trustworthiness and reliability of the expertness reflected therein, and (3) the impossibility of verifying data provided by interviewers because such information is of a privileged nature (137).

Mortality tables have been admitted on the general principle that they are founded on certain and constant data and deal with exact sciences (138). Such a reason seems to imply that every collection of figures that savors of the exact sciences is sufficient to be admitted; but, present day practices discredit such a notion. The more plausible reason for their admission, to the exclusion of others, is that the admission of this collection of data is demanded by custom and practical convenience and is relied upon by those members of the general public interested in such data (138). Consequently, the judiciary has relented to its use in the absence of a better yardstick for its problem-solving tasks (135).

The admissibility of standard tables or reports of scientific calculations of all sorts, as discovered in severance damage studies, economic impact studies, and other research results, in some circumstances may be argued for on the analogy of this exception for U.S. Census reports and mortality tables (138). Whether such a general rule can be regarded as established on the basis of the admission of such data is doubtful, but some decisions have been made that would seem to suggest this trend (139).

Commercial lists and reports

Recognition, as being within an exception to the hearsay rule, is also given to certain commercial and professional lists and reports; namely, market reports, price lists, and quotations contained in newspapers and trade journals (140). "These documents may be described as privately printed documents published for the use of the trade or profession, or public generally, containing statements of contemporaneous facts that are accepted as reliable and acted upon by persons to whom they are furnished, and attaining currency solely because of the accuracy of their statements" (141). Their admission in some cases is premised upon judicial principles (142), in others, upon statutory mandates (143) that, in most instances, have carried out hints originally given by the courts.

Such data are deemed to be competent evidence of the state of the market and sufficient for informing courts of justice as to market value, because they are based upon a general survey of the whole market and because they constantly are being received and acted upon by persons who transact commercial operations on the faith of them (144). Their trustworthiness is found in the fact that these commercial lists are prepared for use by the trade or profession and are, therefore, habitually made with meticulous care and accuracy so that they will be resorted to and relied upon for business and commercial purposes. Also, the composers and writers of these reports and lists know that their work will have no commercial or professional market

value unless it is accurate, and that any inaccuracies more than likely will be discovered. Moreover, composers and writers of commercial lists have no motives to deceive the users thereof. The constant use of such reports and lists also tests their accuracy and sanctions their reliability (145).

Unlike census reports and mortality tables, market reports and price lists have not enjoyed the status of being universally admitted, without attached qualifications, as an exception to the hearsay rule. An appreciable number of States follow the Michigan rule (146), which requires some evidence to show: (1) either how the trade journal or newspaper obtains its information or (2) that those dealing in the trade or profession rely on such newspaper or journal for information as to market value. A few courts have yet to depart from the application of the strict New York rule (147), later modified by New York (148), that requires a prior showing of source and method of compilation. Such a requirement can present almost insuperable problems of proof in cases where the market value at a distant point is in issue and it becomes necessary to use documents that originated at that point, and/or when the market report covers a large region or even the whole country (149). Several jurisdictions consistently have admitted documentary evidence as to market value without a decision as to the necessity of a prior showing of trustworthiness; many of these decisions are accompanied by language that raises a question as to whether any such foundation was laid or was required to be laid (150).

No question is raised here as to whether a prior showing of trustworthiness or some substitute therefor is a proper rule for admitting such documentary evidence. It is indeed rare to regard as reversible error the failure to require a preliminary showing of source or general reliance in the introduction of documentary evidence. In many cases, such a preliminary showing has consisted only of testimony by the party offering the document (151). It is questionable whether such a showing constituted any greater guarantee of trustworthiness than the document itself provided. If the opposing party has equal access to price information and market data and equal opportunity to introduce evidence on a point under the adversary theory of procedure, he should not be allowed to win the point without doing more than standing up to object. In some cases, the time and money involved in the trial of a lawsuit has been ignored, and recovery on an admittedly good cause of action has been limited to nominal damages because of the failure to make a showing (152).

Oral testimony

As a corollary to the admission of commercial documents, it would seem that oral testimony based on such documents would be admissible. Such an inference has not been substantiated by case law. While most States permit an expert to base his testimony on such documents (153), it has been held by a small minority that such oral testimony was incompetent when based solely on documentary

sources. This minority ruling has been based on the startlingly incompatible ground that the documents themselves would not be admissible because they were not the best evidence (154). Seemingly, such decisions leave ample room for the use of documentary sources by experts, but prohibit the mere parroting of documents by the unqualified and place attention on the credibility of the writing itself (155). An overwhelming majority of decisions on the proof of market value by the use of documentary sources has involved the use of the documents themselves as evidence, and not as sources for oral testimony. Such a practice leads to the conclusion that, in practice at least, commercial and professional circles have adopted the better alternative.

The disinterest in the subject matter by those preparing them and the reliability of market reports and lists of current prices in journals and newspapers used by the trade, as well as census reports, mortality tables, or authoritative works in any field of scholarship, would seem to warrant their use in the courtroom as equal evidence of the facts contained therein (156). The legislators in a few States have tried to establish this tenor of equality by enacting statutes authorizing the use of such works as evidence as ". . . facts of general notoriety and interest" (158). The courts generally have declined to sanction a broad exception to the hearsay rule for such works (159).

Court Limitations on Admission of Research Opinion

The courts' admission into evidence of statistical surveys, samples, and research opinion evidence is still amazingly limited (160). Although the admission of census sampling and the averages and probabilities of mortality tables would seem to sanction the admission of other survey data, the courts have not so reasoned. While the substance of samples, opinion research, and other collections of data have been said to possess at least equal inductive value, being made with equal or greater thoroughness, sifted, arranged, and stated by trained observers, they are by the same discriminative authority relegated to the limbo of hearsay and other judicial abominations. The error lies not in looking too leniently upon census samples and mortality tables, but in a misconception of the true qualities of other scientific work (161).

Statistics are a science, the study and application of statistics require expert knowledge and method; this science is the process by which decisions are made, based upon incomplete knowledge. It also is a process used for generalizing from a part to the whole; it is used in attempts to solve a group of problems treated in philosophy by inductive logic. Statistical inferences are inductive because certain traits are assigned to large accumulations of objects by knowledge of these same traits for only a few of these objects (162). Like mortality tables, such statistical data also are founded in the theory of probability, which permits measurement of the

magnitude of possible error in the result and a definite probability statement about the uncertainty of the inference (163).

Up to the present time, statistical surveys, samples, and opinion polls have been used sparingly in judicial problem solving; their use has been limited to admission as an exception to the general rule, not for the truth of the matter asserted but for the fact that it was made (164). Additional limitations have permitted such data to be used only in certain litigable areas. These areas comprise: Commercial law, both public and private; patent and trademark infringement; unfair competition; deceptive advertising; misbranding; and related areas (165) where consumer reaction is important. To a limited extent, their admission in antitrust cases has given some credence to surveys and opinion polls (166).

Use of statistical evidence

There are numerous areas of law in which statistical surveys and sampling of opinion (167) may be crucial to the disposition of a case, and in which such surveys have been used. It already has been indicated that statistical survey research is most important in cases involving commercial disagreements. Such surveys and polls also have been used in the fields of law dealing with immigration, naturalization, and deportation (168); in cases involving change of venue (169); and in quasi-legislative proceedings (170). On the other hand, in litigation concerned with property valuation and condemnation, surveys and polls rarely have been utilized in evidence, and these could be most useful (171).

Sampling results considered hearsay

Admission of sampling results has been limited in judicial proceedings because of technical objections; such results are considered to be hearsay evidence that relies on out of court statements as to the characteristics of basic data or sample data. It has been held that the conclusion of the statistician is merely opinion as to matters that do not fall within the range of admissible opinion evidence, and that statistical data and inferences therefrom are not the best evidence available of the characteristics of basic data (172). Evidence from sampling and polling also has been subjected to the suspicions of judges who realized the ease with which over zealous lawyers, seeking to advance the cause of their clients, could have been tempted to bias such data, and the difficulty of detecting such bias (173). Reputable research organizations, however, enjoy the same confidential relationship to their clients as do reputable members of the bar: They will not countenance perjured testimony in their behalf. Their system of analysis, design of experiment, and the full results of their efforts are all open to judicial review, the court willing. The legitimate opinion research organization wants its findings to be considered public property in the sense that they cannot be perverted in support of any single side and that the full implications, involving qualifications where they exist, be revealed (174).

Another factor militating against the admissibility of sampling and polling data as evidence is that adverse parties sometimes offer other polls by which they purport to prove inconsistent propositions of fact are shown in the data presented as evidence (175). However, in such instances, it would seem that the conflicting testimony on the reliability of the data should be considered in connection with the credibility of the evidence and not with the admissibility of the evidence.

Minimizing objections to sampling

To minimize the bases for objection to the admission of statistical data as evidence, the following procedures might be helpful: (1) The use of pretrial conferences, where feasible, for having the parties start with the same set of instructions and the same basic facts (176). (2) The service upon the adversary, in advance of trial, of a copy of the statistical report, along with a statement of the underlying materials, their location, and availability for inspection (177). (3) The qualifying of the official who conducted the research, by the party offering the document. (4) The testimony of the official as an authenticating witness if the adverse party requests it and shows cause (178).

If the hearsay objection is considered too difficult to be overcome in getting evidence of the poll or sample into the record for the court's consideration, another basis remains for bringing the results to the attention of the court. Quite often, a judge will take judicial notice of well-known facts and opinions (179). In this connection, statistical research findings deserve consideration by the judge as an alternative to his impressions. When used in this sense, as judicial notice, such statistical research findings need not conform to the technical rules of evidence.

REASONS FOR USE OF RESEARCH EVIDENCE IN CONDEMNATION PROCEEDINGS

The current use, and the objectives and extent of the usage, of research evidence in condemnation proceedings has been described. It seems worthwhile to summarize here the reasons considered valid for the general acceptance and use of research evidence in condemnation proceedings.

● Economic research would become an additional step in the evolutionary process of obtaining adequate and accurate ways and means of estimating the value of land. Already

in the evolutionary process, comparable sales information on particular parcels is admissible in some States as direct evidence, if the foundation for each parcel is separately and individually made. As was pointed out in connection with the discussion on economic data in condemnation proceedings, a means of obtaining suitable comparable sales data and other relevant facts associated with such sales is now available. The next step of admitting the same type of sale information in aggregate or statistical form should be taken. Suppose one issue in a condemnation proceeding is the determination of the trend in land prices for a particular community over a period of years. The only way to determine precisely such prices is to tabulate records of sales, which may run into tens, hundreds, or even thousands of individual sales. In such a case, admission of survey evidence appears to be essential; it would save time and money while keeping the record clear of the various underlying source materials.

● "To preserve the vitality of its functions, the law, as it relates to the market place, must keep pace with evolutions in the market place" (180). Research evidence is the keystone of all of today's problem-solving methods. Its use has been pinpointed in the courtroom, as well as in commercial and professional circles.

● Analytically, the general types of land economic studies and land value surveys, which have been discussed, may be designated as hearsay because they are based upon valuations of property made by persons not represented in these proceedings. But, the principles that have supported the admission of census reports, mortality tables, market reports, and price lists will, and should, allow such economic data to be given as evidence in condemnation proceedings. From this brief specified study of research evidence and the hearsay rule in judicial proceedings, it is apparent that two main hurdles must be overcome before economic research evidence such as land economic studies and surveys will be admitted as an exception to the hearsay rule.

● The first hurdle is necessity. The information presented here shows clearly that facts on which land value estimates can be substantiated and supported are needed urgently by public officials, fee appraisers, lawyers, and juries. The courts are sufficiently aware of this need, for in 1960 alone, 16 appeals cases were handed down in which the only issue on appeal was whether the verdict was supported by the evidence (181).

In four cases, the lower courts had made awards that shocked the respective appellate courts so that the original awards were reversed (182). In addition, decisions on three cases were reversed on the findings that the awards were not within the range of evidence (183). Acceptance of the results of: (1) a scientifically designed sample of sales prices for properties within an area, (2) a properly prepared and conducted opinion survey designed to determine various influences on land values, (3) an impact study (4) a severance damage study, and/or (5) other economic data as an exception to the hearsay rule would seem to hold the promise of furnishing material to meet this shortage of factual data.

● The second hurdle is the trustworthiness of the document. The guarantee that such economic studies and statistics would be trustworthy and reliable is to be found in the conditions and procedures with respect to their preparation. In addition, the State highway departments or the universities associated with them in these endeavors would be unlikely to stake their reputations upon ill-conceived studies. The motive, in other words, is precisely the same in character and is more certain in its influence than that which is accepted as sufficient in some of the other hearsay exceptions previously discussed; it is the unwelcome probability of a detection and exposure of errors.

● In addition to their admission as an exception to the hearsay rule, there seem to be good reasons for land economic studies and surveys to come into evidence through judicial notice. Such admission would of necessity be premised upon their undisputed authenticity, thereby obviating the necessity for testimony by a witness vouching for such.

● The public document rule also seems to be another vehicle that can be used as a reason for admitting these land studies as evidence in condemnation proceedings. Their admission under such an exception would depend upon whether they had been prepared by governmental agencies, within the scope of duty imposed upon them by law, or whether it was the usual course of business for highway departments to make certain land value studies in connection with condemnation. The important point is that the law of evidence is changing; in many fields of law it is moving in the direction of admission of factual data derived from studies and surveys, and the applications of statistical techniques.

(References begin on p. 93)

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- (21) *U.S. Constitution, Amendment V*, which provides ". . . nor shall private property be taken for public use without just compensation. . ." binds the Federal Government. The due process clause of *U.S. Constitution, Amendment XIV*, as construed in *Chicago, B. & Q. R.R. v. Chicago*, 166 U.S. 226 (1897) imposes substantially the same requirement on the States.
- (22) *United States v. Causby*, 328 U.S. 256 (1946); *Portsmouth Harbor Land & Hotel Co. v. United States*, 260 U.S. 327 (1922); *Friendship Cemetery v. City of Baltimore*, 197 Md. 610, 81 A. 2d 57 (1951); *Penn v. Carolina Va. Corp.*, 231 N.C. 481, 57 S.E. 2d 817 (1950); *Cochran Coal Co. v. Municipal Management Co.*, 380 Pa. 397, 110 A. 2d 345 (1955). This traditional concept of taking has been broadened to render compensable the substantial interference with any of the rights of property ownership in some States. *E.g., In re Forstrom*, 44 *Ariz.* 472, 38 P. 2d 878 (1934); *Liddick v. City of Council Bluffs*, 232 *Iowa* 197, 5 N.W. 2d 361 (1942); *State ex rel. McKay v. Kauer*, 156 *Ohio St.* 347, 102 N.E. 2d 703 (1951).
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- (28) *Newton Girl Scout Council v. Massachusetts Turnpike Authority*, 335 *Mass.* 189, 138 N.E. 2d 769 (1956); *Assembly of God Church v. Vallone*, 150 *A.* 2d 11 (R.I. 1959).
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- (48) *In re Smith St. Bridge*, 234 *App. Div.* 583, 255 N.Y.S. 801 (1932); *Williams v. State Highway Commission*, 252 N.C. 141, 113 S.E. 2d 263 (1960).
- (49) *People ex rel. Department of Public Works v. Loop*, 127 *Calif. App.* 2d 786, 274 P. 2d 885 (1954); *State Highway Board v. Bridges*, 60 *Ga. App.* 240, 3 S.E. 2d 907 (1939); *Department of Public Works & Buildings v. Griffin*, 305 *Ill.* 585, 137 N.E. 523 (1922).
- (50) *MacArthur v. State Highway Department*, 85 *Ga. App.* 500, 69 S.E. 2d 781 (1952); *Case v. State Highway Commission*, 156 *Kans.* 163, 131 P. 2d 696 (1943); *In re Appropriation for Highway Purposes*, 108 *Ohio App.* 1, 160 N.E. 2d 383 (1959); *State v. Meyers*, 292 *S.W. 2d* 933 (Tex. Civ. App. 1956).
- (51) *People ex rel. Department of Public Works v. Loop*, 127 *Calif. App.* 2d 786, 274 P. 2d 885 (1954); *Little v. Burleigh County*, 82 *N.W. 2d* 603 (N.Dak. 1957); *In re Appropriation of Easement for Highway Purposes*, 93 *Ohio App.* 179, 112 N.E. 2d 411 (1952).
- (52) *State Highway Board v. Coleman*, 78 *Ga. App.* 54, 50 S.E. 2d 262 (1948); *State ex rel. State Highway Commission v. Bruening*, 326 *S.W. 2d* 305 (Mo. 1959); *State Highway Commissioner v. National Fireproofing Corp.*, 127 *N.J.L.* 346, 22 *A.* 2d 268 (E. & A. 1941).
- (53) *Special Assessments in Theory and Practice*, a report prepared (1960) for the Bureau of Public Roads by the Economic Research Agency, Madison, Wis., (processed).
- (54) *Roberts v. Richland Irrigation Dist.*, 289 U.S. 71 (1933); see reference 53, pp. 21-37.
- (55) *People v. McReynolds*, 31 *Calif. App.* 2d 219, 87 P. 2d 734 (1939); *Denver Joint Stock Land Bank v. Board of County Commissioners*, 105 *Colo.* 366, 98 P. 2d 283 (1940); *Gilmore v. State*, 208 *Misc.* 427, 143 N.Y.S. 2d 873 (Ct. Cl. 1955).
- (56) *Koelsch v. Arkansas State Highway Commission*, 223 *Ark.* 529, 267 S.W. 2d 4 (1954); *Louisiana Highway Commission v. Grey*, 197 *La.* 942, 2 So. 2d 654 (1941); *State ex rel. State Highway Commission v. Young*, 324 *Mo.* 277, 23 S.W. 2d 130 (1929); *State Highway Commission v. Bailey*, 212 *Oreg.* 261, 319 P. 2d 906 (1957). See also *McRea v. Marion County*, 222 *Ala.* 511, 133 So. 278 (1931); *Board of Commissioners v. Gardner*, 57 *N.Mex.* 478, 260 P. 2d 682 (1953).
- (57) *Louisiana Highway Commission v. Grey*, 197 *La.* 942, 2 So. 2d 654 (1941).
- (58) *State v. Smith*, 237 *Ind.* 72, 143 N.E. 2d 666 (1957); *State ex rel. State Highway Commission v. Young*, 324 *Mo.* 277, 23 S.W. 2d 130 (1929).
- (59) *McCoy v. Union Elevated R.R.*, 247 U.S. 354, 365-66 (1918); *Board of County Commissioners v. Gardner*, 57 *N. Mex.* 478, 260 *Pac.* 2d 682 (1953); *Long v. Shirley*, 177 *Va.* 401, 14 S.E. 2d 375 (1941).
- (60) *Newby v. Platte County*, 25 *Mo.* 258 (1857).
- (61) *Louisiana Highway Commission v. Grey*, 197 *La.* 942, 2 So. 2d 654 (1941); *Petition of Reeder*, 110 *Oreg.* 484, 222 P. 724 (1924); *Demers v. City of Montpelier*, 120 *Vt.* 380, 141 *A.* 2d 676 (1958).
- (62) *State v. Hudson County Board of Chosen Freeholders*, 55 *N.J.L.* 88, 25 *Atl.* 322 (1892); *Hempstead v. Salt Lake City*, 32 *Utah* 261, 90 *Pac.* 397 (1907).
- (63) *Department of Public Works & Building v. Barton*, 371 *Ill.* 11, 19 N.E. 2d 935 (1939).
- (64) *Kane v. City of Chicago*, 392 *Ill.* 172, 64 N.E. 2d 506 (1946); *In re Fourth Ave.*, 125 *Misc.* 133, 210 N.Y.S. 184 (Sup. Ct. 1925), *rev'd* on other grounds, 221 *App. Div.* 458, 223 N.Y.S. 525 (1927); *Wray v. Knoxville, L.F. & J.R.R.*, 113 *Tenn.* 544, 82 *S.W.* 471 (1904).
- (65) *Bauman v. Ross*, 167 U.S. 518, 574-84 (1897).
- (66) *Hamer v. Iowa State Highway Commission*, 250 *Iowa* 1228, 98 N.W. 2d 746 (1959); *Barnes v. North Carolina State Highway Commission*, 250 N.C. 378, 109 S.E. 2d 219 (1959); *Johnson's Petition*, 344 *Pa.* 5, 23 *A.* 2d 880 (1942).
- (67) *Hamer v. Iowa State Highway Commission*, 250 *Iowa* 1228, 98 N.W. 2d 746 (1959).

- (68) *State v. Stoner*, Ala., 122 So. 2d 115 (1960); *Gabriel v. Cor*, 130 Conn. 165, 32 A. 2d 649 (1943); *Barnes v. North Carolina State Highway Commission*, 250 N.C. 378, 109 S.E. 2d 219 (1959); *Johnson's Petition*, 344 Pa. 5, 23 A. 2d 880 (1942).
- (69) *People ex rel. Department of Public Works v. Loop*, 127 Calif. App. 2d 786, 274 P. 2d 885 (1954); *State Highway Board v. Bridges*, 60 Ga. App. 240, 3 S.E. 2d 907 (1939); *Department of Public Works & Buildings v. Griffin*, 305 Ill. 585, 137 N.E. 523 (1922).
- (70) *People ex rel. Department of Public Works v. Schultz Co.*, 123 Calif. App. 2d 925, 268 P. 2d 117 (1954); *State Highway Board v. Bridges*, 60 Ga. App. 240, 3 S.E. 2d 907 (1939); *State ex rel. State Highway Commission v. White*, 254 S.W. 2d 668 (Mo. App. 1953); *D'Angelo v. Director of Public Works*, 152 A. 2d 211 (R.I. 1959).
- (71) *Department of Public Works v. Barton*, 371 Ill. 11, 19 N.E. 2d 935 (1939); *In re Appropriation for Highway Purposes*, 93 Ohio App. 179, 112 N.E. 2d 411 (1952); *State Highway Commission v. Bailey*, 212 Ore. 261, 319 P. 2d 906 (1957).
- (72) See reference 70.
- (73) See references 70 and 71.
- (74) *Sorensen v. Cor*, 132 Conn. 583, 586-87, 46 A. 2d 125, 126 (1946).
- (75) Alabama: Ala. Code Ann., tit. 19, §§ 4, 10-16 (1940) (with right to appeal to common law jury in trial *de novo*) Georgia: Ga. Code Ann., § 36-401-36-403 (1933) with right to appeal to common law jury in trial *de novo*; Missouri: Mo. Rev. Stat., § 523.040 (1959) (with right to appeal to common law jury in trial *de novo*); Virginia: Va. Code, § 33-63 (1950) (without right to appeal to common law jury in trial *de novo*).
- (76) Arizona: Ariz. Const. art. 2, § 23; Ariz. Rev. Stat. Ann., §§ 1146-47 (1956); Florida: Fla. Const. art. 16, § 29; Fla. Stat., § 73.10 (1957); Illinois: Ill. Const. art. II, § 13 (not applicable to the State); Ill. Rev. Stat., c. 47, § 1 (Supp. 1960) (applicable to the State); Massachusetts: Mass. Gen. Laws Ann., c. 79, § 22, c. 80A, § 9 (1958).
- (77) *Shoemaker v. United States*, 147 U.S. 282, 303-06 (1893); *In re Bronx Parkway Commission*, 206 App. Div. 526, 202 N.Y.S. 249 (1923). *Pruner v. State Highway Commissioner*, 173 Va. 307, 4 S.E. 2d 393 (1939).
- (78) *Shoemaker v. United States*, 147 U.S. 282, 303-06 (1893).
- (79) *City of Chicago v. Harbecke*, 409 Ill. 425, 100 N.E. 2d 616 (1951).
- (80) *Hance v. State Roads Commission*, 221 Md. 164, 171, 156 A. 2d 644, 647 (1959).
- (81) *Epstein v. Boston Housing Authority*, 317 Mass. 297, 299, 58 N.E. 2d 135, 137 (1944).
- (82) *Epstein v. City & County of Denver*, 133 Colo. 104, 293 P. 2d 308 (1956); *Mississippi State Highway Commission v. Taylor*, 237 Miss. 847, 116 So. 2d 757 (1960); *In re Ohio Turnpike Commission*, 164 Ohio St. 377, 131 N.E. 2d 397 (1955); cert. denied 352 U.S. 806 (1957); *B & K, Inc. v. Commonwealth*, 398 Pa. 518, 159 A. 2d 206 (1960).
- (83) *Mississippi State Highway Commission v. Taylor*, 237 Miss. 847, 853, 116 So. 2d 757, 760 (1960); cf. *Eames v. Southern N.H. Hydro-Elect. Corp.*, 85 N.H. 379, 381-82, 159 Atl. 128, 129 (1932); *State v. Peek*, 1 Utah 2d 263, 271, 265 P. 2d 630, 636 (1953).
- (84) *Epstein v. City & County of Denver*, 133 Colo. 104, 108-09, 293 P. 2d 308, 310 (1956).
- (85) *State v. Peek*, 1 Utah 2d 263, 273, 265 P. 2d 630, 637 (1953); *Templeton v. State Highway Commission*, 254 N.C. 337, 118 S.E. 2d 918 (1961); *Pittsburgh Terminal Warehouse & Transfer Co. v. Pittsburgh*, 330 Pa. 72, 198 Atl. 632 (1938).
- (86) *County of Los Angeles v. Faus*, 48 Calif. 2d 672, 312 P. 2d 680 (1957); *Redfield v. Iowa State Highway Commission*, 251 Iowa 332, 99 N.W. 2d 413 (1959); *Village of Lawrence v. Greenwood*, 300 N.Y. 231, 90 N.E. 2d 53 (1949).
- (87) *Stewart v. Commonwealth*, 337 S.W. 2d 880, 884 (1960); *State v. Peek*, 1 Utah 2d 263, 272, 265 P. 2d 630, 636 (1953).
- (88) *Forest Preserve Dist. v. Kean*, 298 Ill. 37, 131 N.E. 117 (1921).
- (89) *Stewart v. Commonwealth*, 337 S.W. 2d 880, 883 (1960); *State v. Peek*, 1 Utah 2d 263, 273, 265 P. 2d 630, 637 (1953).
- (90) *County of Los Angeles v. Faus*, 48 Calif. 2d 672, 312 P. 2d 680 (1957); *Department of Public Works & Buildings v. Drabnick*, 14 Ill. 2d 28, 150 N.E. 2d 593 (1958); *Application of Port of New York Authority*, 28 N.J. Super. 575, 101 A. 2d 365 (App. Div. 1953); *State v. Peek*, 1 Utah 2d 263, 265 P. 2d 630 (1953).
- (91) *State ex rel. Department of Highways v. Barber*, 238 La. 587, 115 So. 2d 864 (1959).
- (92) *Gardner v. Brookline*, 127 Mass. 358 (1879).
- (93) *Knollman v. United States*, 214 F. 2d 106 (6th Cir. 1954) (suitable for industrial development).
- (94) *Vann v. State Highway Department*, 95 Ga. App. 243, 97 S.E. 2d 550 (1957); *Stewart v. Commonwealth*, 337 S.W. 2d 880 (Ky. 1960).
- (95) *County of Los Angeles v. Faus*, 48 Calif. 2d 672, 312 P. 2d 680 (1957); *Application of Port of New York Authority*, 28 N.J. Super. 575, 101 A. 2d 365 (App. Div. 1953).
- (96) *Epstein v. Boston Housing Authority*, 317 Mass. 297, 58 N.E. 2d 135 (1944) (similar property); *State ex rel. State Highway Commission v. Rauscher*, 291 S.W. 2d 89 (Mo. 1956) (same property); *Application of Port of New York Authority*, 28 N.J. Super. 575, 101 A. 2d 365 (App. Div. 1953) (similar property); *Thompson v. State*, 319 S.W. 2d 368 (Tex. Civ. App. 1958) (same property).
- (97) *Congregation of the Mission of St. Vincent de Paul v. Commonwealth*, 336 Mass. 357, 145 N.E. 2d 681 (1957); *Phelps v. State*, 157 S.W. 2d 955 (Tex. Civ. App. 1942).
- (98) *Stewart v. Commonwealth*, 337 S.W. 2d 880 (Ky. 1960); *Robards v. State*, 285 S.W. 2d 247 (Tex. Civ. App. 1955). *Contra*, *County of Los Angeles v. Faus*, 48 Calif. 2d 672, 312 P. 2d 680 (1957).
- (99) *Forest Preserve Dist. v. Kean*, 298 Ill. 37, 131 N.E. 117 (1921).
- (100) *United States v. Katz*, 213 F. 2d 799 (1st Cir. 1954); cert. denied, 348 U.S. 857 (1954); *City & County of Denver v. Quick*, 108 Colo. 111, 113 P. 2d 999 (1941).
- (101) *Phelps v. State*, 157 S.W. 2d 955 (Tex. Civ. App. 1942).
- (102) *Redfield v. Iowa State Highway Commission*, 251 Iowa 332, 99 N.W. 2d 413 (1959); cf. *In re Ohio Turnpike Commission*, 164 Ohio St. 377, 131 N.E. 2d 397 (1955); *Contra*, *City & County of Denver v. Quick*, 108 Colo. 111, 113 P. 2d 999 (1941).
- (103) *Montana Ry. v. Warren*, 137 U.S. 349 (1890).
- (104) *People v. Al. G. Smith Co.*, 86 Calif. App. 2d 308, 194 P. 2d 750 (1948); *State v. Peterson*, 134 Mont. 52, 323 P. 2d 617 (1958); *Application of Port of New York Authority*, 28 N.J. Super. 575, 101 A. 2d 365 (App. Div. 1953).
- (105) *State ex rel. Department of Highways v. Hub Realty Co.*, 239 La. 154, 118 So. 2d 364 (1960); *Port of New York Authority v. Howell*, 59 N.J. Super. 343, 157 A. 2d 731 (Law Div. 1960).
- (106) *Blount County v. Campbell*, 268 Ala. 548, 109 So. 2d 678 (1959); *State ex rel. State Highway Commission v. Devenyns*, 179 S.W. 2d 740 (Mo. App. 1944).
- (107) *Shelby County v. Baker*, 269 Ala. 111, 110 So. 2d 896 (1959); *Department of Public Works & Buildings v. Pellini*, 7 Ill. 2d 367, 131 N.E. 2d 55 (1955); *Muzi v. Commonwealth*, 335 Mass. 101, 138 N.E. 2d 578 (1956).
- (108) *State v. McDonald*, 88 Ariz. 1, 352 P. 2d 343 (1960); *Southwick v. Massachusetts Turnpike Authority*, 339 Mass. 666, 162 N.E. 2d 271 (1959); *Taney County v. Addington*, 304 S.W. 2d 842 (Mo. 1957); *South Carolina State Highway Department v. Hines*, 234 S.C. 254, 107 S.E. 2d 643 (1959).
- (109) *Shelby County v. Baker*, 269 Ala. 111, 110 So. 2d 896 (1959); *Lazenby v. Arkansas State Highway Commission*, 231 Ark. 601, 331 S.W. 2d 705 (1960); *Forest Preserve Dist. v. Krol*, 12 Ill. 2d 139, 145 N.E. 2d 599 (1957); *State ex rel. State Highway Commission v. Devenyns*, 179 S.W. 2d 740 (Mo. App. 1944).
- (110) *Chicago & W.I. R.R. v. Heidenreich*, 254 Ill. 231, 239-40, 98 N.E. 567, 571 (1912).
- (111) *Eisenring v. Kansas Turnpike Authority*, 183 Kans. 774, 332 P. 2d 539 (1958); *Newton Girl Scout Council v. Massachusetts Turnpike Authority*, 335 Mass. 189, 138 N.E. 2d 769 (1956).
- (112) *Application of Port of New York Authority*, 28 N.J. Super. 575, 579, 101 A. 2d 365, 367 (App. Div. 1953).
- (113) *Shelby County v. Baker*, 269 Ala. 111, 110 So. 2d 896 (1959); *State v. McDonald*, 88 Ariz. 1, 352 P. 2d 343 (1960); *Taney County v. Addington*, 304 S.W. 2d 842 (Mo. 1957); *South Carolina State Highway Department v. Hines*, 234 S.C. 254, 107 S.E. 2d 643 (1959).
- (114) *State v. McDonald*, 88 Ariz. 1, 352 P. 2d 343 (1960).
- (115) *Shelby County v. Baker*, 269 Ala. 111, 110 So. 2d 896 (1959); *South Carolina State Highway Department v. Hines*, 234 S.C. 254, 107 S.E. 2d 643 (1959).
- (116) *Taney County v. Addington*, 304 S.W. 2d 842 (Mo. 1957).
- (117) *Arkansas State Highway Commission v. Covert*, 332 S.W. 2d 196 (Ark. 1960); *Randle v. Kansas Turnpike Authority*, 181 Kans. 416, 312 P. 2d 235 (1957); *Southwick v. Massachusetts Turnpike Authority*, 339 Mass. 666, 162 N.E. 2d 271 (1959); *Contra*, *Greene v. State Board of Public Roads*, 50 R.I. 489, 149 Atl. 596 (1930).
- (118) *Besen v. State*, 17 Misc. 2d 119, 130, 185 N.Y.S. 2d 495, 504 (Ct. Cl. 1959).
- (119) *Indianapolis & Cincinnati Traction Co. v. Wiles*, 174 Ind. 236, 91 N.E. 161 (1910); *Mississippi State Highway Commission v. Hillman*, 189 Miss. 850, 198 So. 565 (1940); *City of Houston v. Fisher*, 322 S.W. 2d 297 (Tex. Civ. App. 1959).
- (120) *Johnson's Petition* 344 Pa. 5, 23 A. 2d 880 (1942); *L'Etoile v. Director of Public Works*, 153 A. 2d 173 (R.I. 1959).
- (121) *State Highway Commission v. Byars*, 221 Ark. 845, 256 S.W. 2d 738 (1953).
- (122) *People v. Al. G. Smith Co.*, 86 Calif. App. 2d 308, 194 P. 2d 750 (1948); *Hance v. State Roads Commission*, 221 Md. 164, 156 A. 2d 644 (1959); *Fox-Wisconsin Theatres, Inc. v. City of Waukesha*, 253 Wis. 452, 34 N.W. 2d 783 (1948).
- (123) *City & County of Denver v. Quick*, 108 Colo. 111, 113 P. 2d 999 (1941); *State ex rel. State Highway Commission v. Dockery*, 300 S.W. 2d 444 (Mo. 1957).
- (124) *Covina Union High School Dist. v. Jobe*, 174 Calif. App. 2d 340, 345 P. 2d 78 (1959); *Newton Girl Scout Council v. Massachusetts Turnpike Authority*, 335 Mass. 189, 138, N.E. 2d 769 (1956); *Tennessee Gas Transmission Co. v. Maze*, 45 N.J. Super. 496, 133 A. 2d 28 (App. Div. 1957); *State Highway Commission v. Arnold*, 218 Ore. 43, 341 P. 2d 1089 (1959); *City of Houston v. Huber*, 311 S.W. 2d 488 (Tex. Civ. App. 1958).
- (125) *State Highway Commission v. Arnold*, 218 Ore. 43, 341 P. 2d 1089 (1959).
- (126) *Stewart v. Commonwealth*, 337 S.W. 2d 880, 885 (Ky. 1960); *Tennessee Gas Transmission Co. v. Maze*, 45 N.J. Super. 496, 504, 133 A. 2d 28, 32 (App. Div. 1957).
- (127) Seminar on Protracted Cases, 23 F.R.D. 319, 449 (1957).
- (128) See Note 20, Geo. Wash. L. Rev. 211 (1951).
- (129) "Hearsay evidence is testimony in court or written evidence of a statement made out of court, such testimony being offered as an assertion to show the truth of matters asserted therein; and, thus, resting for its value upon the credibility of the out of court asserter." McCormick, *Evidence*, § 225 (1954).
- (130) See reference 129, p. 301.
- (131) See reference 129, p. 234.
- (132) Zeisel, *The Uniqueness of Survey Evidence*, 45 Cornell L. Q. 322 (1959); McCormick, *Evidence* § 296.
- (133) 13 U.S.C. 195 (1958).
- (134) *Turcotte v. DeWitt*, 332 Mass. 160, 124 N.E. 2d 241 (1955). *Trautloff v. Dannen Mills, Inc.*, 316 S.W. 2d 866 (Mo. App. 1958); *Continental Oil Co. v. Elias*, 307 P. 2d 849 (Okla. 1956).
- (135) State census reports are also judicially noticed in the States of their origin, but reference here will only be made to the United States census reports.
- Alabama: *Pickens County v. Jordan*, 239 Ala. 589, 196 So. 121 (1940).
- Arizona: *Hernandez v. Frohmler*, 68 Ariz. 202 P. 2d 854 (1959).
- California: *People ex rel. Stoddard v. Williams*, 64 Calif. 87, 27 Pac. 939 (1883).
- Colorado: *In re Constitutionality of Senate Bill No. 293*, 21 Colo. 38, 39 Pac. 522 (1895).
- Florida: *Budget Commission v. Blocker*, 60 So. 2d 193 (Fla. 1952).
- Georgia: *Tift v. Bush*, 209 Ga. 769, 75 S.E. 2d 805 (1953).
- Idaho: *City of Twin Falls ex rel. Cannon v. Koehler*, 63 Idaho 562, 123 P. 2d 715 (1942).
- Illinois: *Coal Creek Drainage Levee Dist. v. Sanitary Dist.*, 336 Ill. 11, 167 N.E. 807 (1929).
- Indiana: *Groves v. Board of Commissioners*, 199 N.E. 137 (Ind. 1936).
- Iowa: *State v. Braskamp*, 87 Iowa 588, 54 N.W. 532 (1893).
- Kansas: *Sparks v. Sparks*, 301 Ky. 576, 192 S.W. 2d 724 (1946).
- Mississippi: *Ross v. Morrismac Veneer Co.*, 129 Miss. 693, 92 So. 823 (1922).
- Missouri: *State v. Public Serv. Commissioners*, 334 Mo. 985, 70 S.W. 2d 52 (1934).
- Montana: *Hill v. Rae*, 52 Mont. 348, 158 Pac. 826 (1916).
- Nebraska: *Kokes v. State*, 55 Nebr. 691, 76 N.W. 467 (1898).
- New Jersey: *Michaels v. Johnson*, 33 N.J. Super. 77, 109 A. 2d 452 (1954).
- New York: *Taylor v. City of White Plains*, 206 Misc. 946, 135 N.Y.S. 2d 773 (Sup. Ct. 1954).
- North Carolina: *Clark v. City of Greenville*, 221 N.C. 255, 20 S.E. 2d 56 (1942).
- Oklahoma: *Jones v. Freeman*, 193 Okla. 554, 146 P. 2d 564 (1943), appeal dismissed, 322 U.S. 717 (1944).
- Oregon: *Smith v. Jefferson*, 75 Ore. 179, 146 Pac. 809 (1915).
- Pennsylvania: *Commonwealth v. Walter*, 274 Pa. 553, 118 Atl. 510 (1922).
- South Carolina: *Richards v. City of Columbia*, 227 S.C. 538, 88 S.E. 2d 683 (1955).
- Texas: *L. E. Whitman & Co. v. Allen*, 64 S.W. 2d 1024 (Tex. Civ. App. 1933).

Virginia: *Shelton v. Sydnor*, 126 Va. 625, 102 S.E. 83 (1920).

Washington: *State v. Smith*, 149 Wash. 173, 270 Pac. 306 (1928), judgment adhered to on rehearing, 155 Wash. 173, 284 Pac. 796 (1930).

Wisconsin: *Grimm v. Bayfield County*, 174 Wis. 43, 182 N.W. 466 (1921).

Mortality tables:

Alabama: *Great So. Ry. v. Norrell*, 225 Ala. 503, 143 So. 904 (1932).

California: *Froeming v. Stockton Elec. Ry.*, 171 Calif. 401, 153 Pac. 712 (1915).

Connecticut: *Strakosch v. Connecticut Trust & Safe Deposit Co.*, 96 Conn. 471, 114 Atl., 660 (1921).

Florida: *Harvey v. Rhea*, 152 Fla. 817, 12 So. 2d 302 (1943).

Illinois: *Muhlke v. Tiedemann*, 280 Ill. 534, 177 N.E. 708 (1917).

Indiana: *Dallas & Maris Forwarding Co. v. Hiddell*, 126 N.E. 2d 18, (166 Ind.) App. 113, (1955).

Kansas: *Knoche v. Meyer Sanitary Milk Co.*, 177 Kans. 423, 280 P. 2d 605 (1955).

Kentucky: *Morris v. Morris*, 293 S.W. 2d 243, 245 (Ky. 1956): "We think that we may fairly judicially note the Federal Government's preoccupation with a collection of statistics concerning all vital matters, not only mortality, but also pertaining to such subjects as agriculture, mining, cost of living, etc., and we also recognize the general acceptance by all people of the thorough and workmanlike job which has been done over a long period of years by various Federal agencies to such an extent that many wage contracts have geared the rise and fall of wages and salaries to the rise and fall of the cost of living indices. We know of no more accurate measurement."

Michigan: *Tandy v. Knox*, 313 Mich. 147, 20 N.W. 2d 844 (1945).

Missouri: *Selle v. Selle*, 337 Mo. 1234, 88 S.W. 2d 877 (1935).

Montana: *Stephens v. Elliott*, 36 Mont., 92, 92 Pac. 45 (1907).

New Jersey: *Berry v. President & Directors of the Bank of Manhattan Co.*, 133 N.J. Eq. 164 (1943).

North Dakota: *Guer v. Ryaden*, 74 N.W. 2d 361 (N. Dak. 1955).

Oregon: *Shelton v. Lowell*, 196 Oreg., 430, 249 P. 2d 958 (1952).

Washington: *McTernan v. Heroux*, 77 Wash. 2d 631, 269 P. 2d 815 (1954).

West Virginia: *Drake v. Clay Hardware & Supply Co.*, 157 S.E. 35 (W. Va. 1931).

(136) *Keast v. Santa Ysabel G. M. Co.*, 136 Calif. 256, 68 Pac. 771, 772 (1902): "The court may or may not require such preliminary proof of standard acceptance according to its judgment of the need therefor."; *Valente v. Sierra Ry.*, 151 Calif. 534, 91 Pac. 481, 484 (1907): "In some courts it is said that such tables are admissible after proper preliminary proof of their authenticity and standard quality. Such proof in this case was not made, but the general weight of authority is to the contrary, and permits the introduction of such tables as are satisfactory to the court. Such a ruling is founded upon the theory that the court may take judicial notice of standard tables."; *Hann v. Brooks*, 331 Ill. App. 535, 549, 73 N.E. 2d 624, 630 (1947): "A showing that the tables are used by reputable life insurance companies is sufficient to establish their status as standard authorities." But see *Banks v. Braman*, 195 Mass. 97, 80 N.E. 799 (1907).

(137) See reference 132, p. 325.

(138) 6 Wigmore, *Evidence*, § 1698 (3d ed. 1940).

(139) *Hullberg v. Phillippi*, 169 Kans. 610, 220 P. 2d 208 (1950) (motor-vehicle speed chart admitted); *Whalen v. Town Plan & Zoning Commission*, 146 Conn. 321, 150 A. 2d 312 (1959) (traffic reports showing the heaviest traffic in an area admitted without comment as to its admissibility); *Bruner v. McCarthy*, 105 Utah 399, 142 P. 2d 649 (1943), in which exhibit containing a compilation of figures prepared by expert, based upon mortality annuity tables for purpose of showing what amount of money it would be necessary to invest at various interest rates to pay an individual specified amounts per year for 35 years, admitted. But see *Sloan v. Carolina Power & Light Co.*, 248 N.C. 125, 102 S.E. 2d 822 (1958) (table of Nat'l Elec. Safety Code issued by U.S. Dept. of Commerce, Bureau of Standards, excluded).

For a discussion of the admissibility of commercial and professional lists, see discussion below; for a discussion of the admissibility of interest tables, etc., see 6 Wigmore, *Evidence*, § 1642 (3d ed. 1940). See *United States v. Mortimer*, 118 F. 2d

266 (2d Cir.), cert. den., 314 U.S. 616 (1941), in which the court upheld, in a prosecution for using and conspiring to use the mails to defraud, the admission of a number of charts purporting to show defaults in the payment of taxes on a high proportion of certain mortgaged properties which had been prepared by a prosecution witness, an experienced public accountant, and the reliability of which was not questioned, even though the tax records were not themselves in evidence and all those who participated in their preparation did not testify; *San Francisco v. Superior Court of San Francisco*, 38 Calif. 2d 156, 238 P. 2d 581 (1951), in which the court issued a writ of prohibition to restrain enforcement of an order for the inspection of documents and data claimed to be the records of official proceedings conducted by the Civil Service Commission of San Francisco, which included a wage rate survey in which the commission solicited information from private employers on the written promise and agreement with each that the source of all information supplied would be held in confidence and that the wage scales and other data would not be identified except by a code known only to the commission, such survey being made necessary by the municipal employees in accord with the generally prevailing wages for like service conditions in private employment.

(140) 6 Wigmore, *Evidence* § 1702, 1704 (3d ed. 1940); McCormick, *Evidence* § 296 (1954); Comment, 45 Mich. L. Rev. 748 (1947); Note 39, Harv. L. Rev. 885 (1926).

Alabama: *Farm Industries Div. of Quaker Oats Co. v. Howell*, 39 Ala. App. 131, 95 So. 2d 808 (1957).

Arizona: *Atlantic Nat'l Bank v. Korrick*, 29 Ariz. 486, 242 Pac. 1009 (1926).

Arkansas: *St. Louis & S.F.R.R. v. Pearce*, 82 Ark. 353, 101 S.W. 760 (1907).

Colorado: *Estes v. Denver & R.G.R.R.*, 49 Colo. 378, 113 Pac. 1005 (1910).

Connecticut: *State v. Pambianchi*, 139 Conn. 543, 95 A. 2d 695 (1953).

Georgia: *Columbian Peanut Co. v. Pope*, 69 Ga. App. 26, 24 S.E. 2d 710 (1943).

Idaho: *State v. Jensen*, 47 Idaho 785, 280 Pac. 1039 (1929).

Illinois: *Nash v. Classen*, 163 Ill. 409, 45 N.E. 276 (1828).

Kansas: *Webbler v. Umbach*, 125 Kans. 117, 263 Pac. 786 (1928).

Louisiana: *Friedman Iron & Supply Co. v. J. B. Beard Co.*, 222 La. 627, 63 So. 2d 144 (1952).

Maine: *Washington Ice Co. v. Webster*, 68 Maine 463 (1878).

Maryland: *Jones v. Ortet*, 114 Md. 205, 78 Atl. 1030 (1910).

Michigan: *Sisson v. Cleveland & T. R.R.*, 14 Mich. 489 (1866).

Mississippi: *Dearborn Motors Credit Corp. v. Henton*, 221 Miss. 643, 74 So. 2d 739 (1954).

Missouri: *Bailey v. St. Louis & S.F. Ry.*, 209 S.W. 630 (Mo. App. 1927).

Nebraska: *Allender v. Chicago & N.W. Ry.*, 119 Nebr. 559, 230 N.W. 102 (1930).

New Jersey: *State v. Carrano*, 27 N.J. Super. 382, 99 A. 2d 426 (1953) (criminal case recognizing the rule).

New Mexico: *Johnson v. Nichols*, 66 N. Mex. 181, 344 P. 2d 697 (1959).

New York: *Whelan v. Lynch*, 60 N.Y. 469 (1875); *Watts v. Phillips-Jones Corp.*, 211 App. Div. 523, 207 N.Y.S. 493 (1925), aff'd, 242 N.Y. 557, 152 N.E. 425 (1926).

North Carolina: *Commander v. Smith*, 192 N.C. 159, 134 S.E. 412 (1926).

North Dakota: *Schnitz Bros. v. Bolles & Rogers Co.*, 48 N. Dak. 673, 186 N.W. 96 (1922).

Pennsylvania: *Bounomo v. United Distiller's Co.*, 77 Pa. Super. 113 (1921).

Rhode Island: *National Cash Register Co. v. Underwood*, 56 R.I. 379, 185 Atl. 909 (1936), which recognized the rule but held that price list prepared and extended by company for exclusive reference by its salesmen, and not in any way to be used as a price quotation to the public for actual sale, was not probative evidence of value of that commodity in an open competitive market.

South Carolina: *Kirkpatrick v. Hardeman*, 123 S.C. 21, 115 S.E. 905 (1923).

Texas: *Houston Packing Co. v. Spivey*, 333 S.W. 2d 423 (Tex. 1960). *Allen v. Payne*, 334 S.W. 2d 607 (Tex. Civ. App. 1960).

Utah: *Baglin v. Earl-Eagle Mining Co.*, 54 Utah 572, 184 Pac. 190 (1919).

Washington: *Cron & Dehn, Inc. v. Chelan Packing Co.*, 258 Wash. 167, 290 Pac. 999 (1930).

Wyoming: *Atlantic Nat'l Bank v. Korrick*, 29 Wyo. 468, 242 Pac. 1009 (1926).

Contra, Massachusetts: *Doherty v. Harris*, 230 Mass. 341, 119 N.E. 863 (1918).

(141) Note 39, Harv. L. Rev. 885 (1926).

(142) See reference 140 and 6 Wigmore, *Evidence*, § 1702 (3d ed. 1940).

(143) Code of Ala. ch. 7, 385 (1958); Ky. Rev. Stat. ch. 355, § 2-724 (1960); Mass. Gen. Laws Ann. ch. 106, § 2-724 (1958) (but see Code Comment at the end of section); 6 Wigmore, *Evidence*, § 1704 (3d ed. 1940)). For a statement of Massachusetts law see *Doherty v. Harris*, 230 Mass. 341, 119 N.E. 863 (1918); N. Dak. Century Code ch. 32, § 25-04 (1960); Pa. Stat. ch. 12 A, § 2-724 (1954).

(144) *Sisson v. Cleveland & T. R.R.*, 14 Mich. 489 (1866).

(145) 6 Wigmore, *Evidence*, §§ 1702, 1704 (3d ed. 1940).

(146) For a statement of the rule, see reference 144, Note 21, P. 496. This approach was formulated best in *Mount Vernon Brewing Co. v. Teschner*, 108 Md. 158, 69 Atl. 502 (1908); accord, *Fairley v. Smith*, 87 N.C. 367 (1882). Instead of giving an option as permitted by the Michigan rule, some courts require a showing that the document is relied upon by the trade dealing in the particular article or commodity in question. See, *Johnson v. Nichols*, 66 N. Mex. 881, 344 P. 2d 697 (1959). See generally, 45 Mich. L. Rev. 748 (1947); see reference 145.

(147) The New York rule originated in *Whelan v. Lynch*, 60 N.Y. 469, 474 (1875). It is followed in *Fishel v. F. M. Ball & Co.*, 83 Calif. App. 128, 256 Pac. 493 (1927); *Willard v. Mellor*, 19 Colo. 534, 36 Pac. 148 (1894); *Fountain v. Wabash Ry.*, 114 Mo. App. 676, 90 S.W. 393 (1905); *Schnitz Bros. v. Bolles & Rogers Co.*, 48 N. Dak. 673, 186 N.W. 96 (1921); *Baglin v. Earl-Eagle Mining Co.*, 54 Utah 572, 184 Pac. 190 (1919).

(148) In *Burns Mfg. Co. v. Clinchfield Products Corp.*, 189 App. Div. 569, 178 N.Y.S. 483 (1919), the court adopted a test of general reliance without commenting on *Whelan*. In *Watts v. Phillips-Jones Corp.*, 211 App. Div. 523, 207 N.Y.S. 493 (1925), the court also applied the test of general reliance, and modified *Whelan* by stating that a showing of source and method of compilation was not the only basis for qualifying a document. In *von Rectzenstein v. Tomlinson*, 249 N.Y. 60, 162 N.E. 584 (1928), the court expressed a preference for the test of general reliance.

(149) *Chicago, B. & Q. Ry. v. Todd*, 74 Nebr. 712, 105 N.W. 83 (1905); *Mount Vernon Brewing Co. v. Teschner*, 108 Md. 158, 69 A. 502 (1908); *Marden, Orth & Hastings Corp. v. Trans-Pacific Corp.*, 109 Wash. 296, 186 Pac. 884 (1920).

(150) *Webbler v. Umbach*, 125 Kans. 117, 263 Pac. 786 (1928); *Jordan v. Miller*, 232 Mich. 8, 204 N.W. 708 (1925).

(151) *St. Louis I. M. & S. R.R. v. Laser*, 120 Ark. 119, 179 S.W. 189 (1915).

(152) *Kentucky Refining Co. v. Conner*, 145 Ala. 664, 39 So. 728 (1905); *Schnitz Bros. v. Bolles & Rogers Co.*, 48 N. Dak. 637, 186 N.W. 96 (1922).

(153) *Howell v. Hines*, 298 Mo. 282, 249 S.W. 924 (1923); *Fountain v. Wabash Ry.*, 114 Mo. App. 676, 90 S.W. 393 (1905).

(154) *Doherty v. Harris*, 230 Mass. 341, 119 N.E. 863 (1918); *National Bank of Commerce v. New Bedford*, 175 Mass. 257, 56 N.E. 288 (1900).

(155) 45 Mich. L. Rev. 748, 752 (1947).

(156) 6 Wigmore, *Evidence*, §§ 1690-92 (3d ed. 1940); Note 19, St. Louis L. Rev. 353 (1934).

(157) California was the first State to enact such a statute: "Historical works, books of science or art, and published maps or charts, when made by persons indifferent between the parties are *prima facie* evidence of facts of general notoriety and interest." Calif. Code Civil Proc. § 1936. Other States have enacted statutes similar to the California statute: Ala. Code Ann. ch. 7, § 413 (1940); Idaho Code § 9-402 (1948); Iowa Code Ann. § 622-23 (1958); Mont. Rev. Code Ann. § 93-1101-8 (1947); Nebr. Rev. Stat. § 25-1218 (1956); Oreg. Rev. Stat. § 41.670 (Supp. 1959); Utah Code Ann. § 78-25-6 (1953).

(158) *The Uniform Rules of Evidence*, Rule 63 (31), adapted from the *Model Code of Evidence*, Rule 529.

(159) Alabama is the only jurisdiction that has construed such a statute as permitting the direct admission of medical books, extracts, and treatises, without qualification as to purpose or case. The other States having such statutes have uniformly construed these statutes as not to allow direct admission of medical works. *City of Dothan v. Hardy*, 237 Ala. 603, 188 So. 264 (1934), admitting such works, and the following, which deny such admission: *Brown v. L. A. Transit Lines*, 282 P. 2d 1032 (Calif. App. 1955); *Wilcox v. Crumpton*, 219 Iowa 389, 258 N.W. 704 (1935), recognizing the rule; *Osborn v. Gray*, 28 Idaho 89, 152 Pac. 473 (1915). States not having such statutes follow the common law rule

(Continued on p. 38)

STATE LEGAL MAXIMUM LIMITS OF MOTOR VEHICLE

Prepared by the Bureau

Line	State	Width inches ¹	Height ft.-in.	Length—feet ²				Number of towed units ³			Axle load—pounds				Type of regulation
				Single unit		Truck tractor semi-trailer	Other combination	Semi-trailer	Full trailer	Semi-trailer and full trailer	Single		Tandem		
				Truck	Bus						Statutory limit	Including statutory enforcement tolerance	Statutory limit	Including statutory enforcement tolerance	
1	Alabama	96	13-6	35	40	50	NP	1	NP	NP	18,000	19,800	36,000	39,600	Table
2	Alaska	96	12-6	35	40	60	60	1	1	2	18,000		32,000		Table-tire
3	Arizona	96	13-6	40	40	65	65	1	1	2	18,000		32,000		Table
4	Arkansas	96	13-6	35	40	50	50	1	1	NP	18,000	18,500	32,000	32,500	Spec. maxi
5	California	96	13-6	35	35	60	65	NR	NR	NR	18,000		32,000		Table
6	Colorado	11 96	12 13-6	35	40	60	60	1	2	2	18,000		36,000		Formula-s
7	Connecticut	102	12-6	50	50	50	NP	1	NP	NP	22,400	22,848	36,000	36,720	Spec. lim-
8	Delaware	96	6 12-6	40	42	50	60	1	1	2	20,000		36,000		Table-spec
9	District of Columbia	96	12-6	40	40	50	80	1	1	NP	22,000		38,000		Table
10	Florida	96	13-6	14 35	40	55	55	1	1	NP	20,000	22,000	40,000	44,000	Table
11	Georgia	96	13-6	15 +39	15 +45	50	50	1	1	NP	18,000	20,340	36,000	40,680	Spec. maxi
12	Hawaii	108	13-0	40	40	55	65	1	1	2	24,000		32,000		Formula 17
13	Idaho	11 96	14-0	35	19 40	60	65	1	1	2	20 18,000		20 32,000		Table 20
14	Illinois	96	13-6	42	42	25 55	25 60	1	1	2	21 18,000		32,000		Spec. lim-
15	Indiana	96	13-6	36	40	50	50	1	1	2	23 18,000	23 19,000	23 32,000	23 33,000	Spec. lim-
16	Iowa	96	13-6	35	19 40	50	50	1	24 1	NP	18,000	18,540	32,000	32,960	Table
17	Kansas	96	13-6	35	19 40	50	50	1	1	NP	18,000		32,000		Table
18	Kentucky	96	12 13-6	26 35	26 35	27 50	NP	1	NP	NP	18,000	28 18,900	32,000	28 33,600	Spec. lim-
19	Louisiana	96	13-6	35	19 40	50	60	1	1	NP	18,000		32,000		Axle lim-
20	Maine	96	30 12-6	55	55	55	55	1	1	NP	30 22,000		30 32,000		Table-tire
21	Maryland	18 96	6 12-6	55	55	55	40 55	NR	NR	NP	22,400		31 40,000		Formula
22	Massachusetts	96	NR	35	19 40	50	NP	1	NP	NP	22,400		36,000		Table-sp
23	Michigan	96	13-6	35	40	55	55	1	1	2	33 18,000		34 32,000		Axle lim-
24	Minnesota	96	13-6	40	40	50	50	1	1	NP	18,000		32,000		Table
25	Mississippi	96	6 12-6	35	40	50	50	1	1	NP	18,000		28,650	35 32,000	Table-tire
26	Missouri	96	12-6	35	40	50	50	1	1	2	18,000		32,000		Table
27	Montana	11 96	13-6	35	40	60	60	1	1	1	18,000		32,000		Table
28	Nebraska	96	13-6	40	40	60	60	1	1	2	18,000	18,900	32,000	33,600	Table
29	Nevada	96	NR	NR	NR	NR	NR	NR	NR	NR	18,000	18,900	32,000	33,600	Table
30	New Hampshire	96	13-6	35	35 40	50	50	NR	NR	NR	22,400		36,000		Tables-s
31	New Jersey	44 96	44 13-6	35	39 35	50	40 50	1	1	NP	22,400	23,520	32,000	33,600	Spec. lim
32	New Mexico	41 96	13-6	40	40	65	65	1	1	2	21,600		34,320		Table
33	New York	96	13-0	35	42 35	50	50	1	1	NP	22,400		36,000		Formula
34	North Carolina	96	6 12-6	35	19 40	43 50	43 55	1	1	NP	18,000	19,000	36,000	38,000	Spec. lim
35	North Dakota	96	13-6	14 35	19 40	60	60	1	1	2	18,000		32,000		Formula
36	Ohio	96	13-6	35	19 40	50	60	1	NR	NR	19,000		31,500		Formula
37	Oklahoma	96	13-6	35	45	45 60	45 60	1	1	NP	18,000		32,000		Table
37	Oregon	96	12 13-6	35	35 40	46, 35 55	35 65	1	1	35 2	47 18,000		47 32,000		Table 48
38	Pennsylvania	96	6 12-6	35	19 40	56 50	40 50	1	1	NP	22,400	23,072	36,000	37,080	Spec. lim
39	Puerto Rico	96	12-6	35	35	50	50	1	1	NP	NS		NS		Spec. lim
40	Rhode Island	102	12-6	40	40	50	50	1	1	NP	22,400		NS		Spec. lim
42	South Carolina	96	13-6	14 35	19 40	55	59 60	1	1	NP	20,000		32,000		Table
43	South Dakota	96	13-6	35	40	60	60	1	1	2	18,000		32,000		Table
44	Tennessee	96	6 12-6	35	40	50	50	1	53 1	NP	18,000		32,000		Table
45	Texas	96	13-6	35	40	50	50	1	1	NP	18,000	18,900	32,000	33,600	Table
46	Utah	96	14-0	45	45	60	60	NR	NR	NR	18,000		64 33,000		Table 65
47	Vermont	96	12-6	50	50	50	50	1	1	NP	NS		NS		Spec. lim
48	Virginia	96	6 12-6	35	35 40	50	50	1	1	NP	18,000		57 32,000		Table
49	Washington	96	13-6	35	19 40	60	58 65	1	1	58 2	18,000	18,000	32,000	32,000	Table-sp
50	West Virginia	96	6 12-6	35	19 40	50	50	1	1	NP	18,000	18,900	32,000	33,600	Table
51	Wisconsin	96	13-6	35	40	50	50	1	1	NP	18,000	60 19,500	30,400	32,000	Table 61
52	Wyoming	96	13-6	40	40	65	65	1	1	2	18,000		32,000	62 36,000	Table
	AASHO Policy	96	12-6	35	19 40	50	60	1	1	NP	18,000		32,000		Table
	Number of States		Higher Same Lower	3 49 0	45 7 0	18 34 0	31 16 5	23 29 0	11 9 0	5 47 0	6 42 4	25 27 0	31 21 0	30 21 1	Formula Table Specific

NP—Not permitted. NR—Not restricted. NS—Not specified.

¹ Various exceptions for farm and construction equipment; public utility vehicles; house trailers; urban, suburban, and school buses; haulage of agricultural and forest products; at wheels of vehicles; for safety accessories, on designated highways, and as administratively authorized.

² Various exceptions for utility vehicles and loads, house trailers and mobile homes.

³ When not specified, limited to number possible in practical combinations within permitted length limits; various exceptions for farm tractors, mobile homes, etc.

⁴ Legally specified or established by administrative regulation.

⁵ Computed under the following conditions to permit comparison on a uniform basis between States with different types of regulation:

A. Front axle load of 8,000 pounds.

B. Maximum practical wheelbase within applicable length limits:

(1) Minimum front overhang of 3 feet.

(2) In the case of a 4-axle truck-tractor semitrailer, rear overhang computed as necessary to distribute the maximum possible uniform load on the maximum permitted length of semitrailer to the single drive-axle of the tractor and to the tandem axles of the semitrailer, within the permitted load limits of each.

(3) In the case of a combination having 5 or more axles, minimum possible combined front and rear overhang assumed to be 5 feet, with maximum practical load on maximum permitted length of semitrailer, subject to control of loading on axle groups and on total wheelbase as applicable.

C. Including statutory enforcement tolerances as applicable.

⁶ Auto transports 13 feet 6 inches; Maryland also allows 13 feet 6 inches for vehicles loaded with hay or straw, or carrying flat glass.

⁷ Does not apply to combinations of adjacent load-carrying single axles.

⁸ 56,000 pounds on load-carrying axles, exclusive of steering-axle load.

⁹ On specific routes in urban or suburban service under special permit from P.U.C. 40 feet, also 3-axle buses with turning radius less than 45 feet without restriction.

¹⁰ Except 3-unit combinations may use up to 65 ft. combinations on certain highways designated by the Department of Highways.

¹¹ Buses 102 inches on highways of surfaced width at least 20 feet or otherwise as administratively authorized.

¹² On class AA, or designated highways, 12 ft. 6 in. on other highways; log and lumber trucks limited to 12 ft. 6 in. on all highways in Oregon.

¹³ Legal limit 60,000 pounds, axle spacing 27 feet or more.

¹⁴ Three-axle vehicles 40 feet.

¹⁵ Truck 39.55 feet; bus 45.20 feet.

¹⁶ 63,280 pounds maximum, except on roads under R 1700 (L+40) when L is 18' or less; 800 (L+40) with span of 20' or over.

¹⁷ 700 (L+40) when L is 18' or less; 800 (L+40) with span of 20' or over.

¹⁸ Vehicles loaded with tobacco hogsheads—103 inches.

¹⁹ Less than three axles 35 feet.

²⁰ Special limits for vehicles hauling timber and timber including livestock; single axle 18,900 pounds, tandem permitted 66,000 pounds maximum at 21-foot axle spacing, 110-foot axle spacing.

²¹ On designated highways; 16,000 pounds on other highways.

²² Without tandem axles 45,000 pounds.

²³ On designated highways; single axle 22,400 pounds, excesses of weight under one or more limitations of axle spacing or steering axle.

²⁴ Towing agent must be registered for gross weight.

²⁵ Auto transports only, 60 feet.

²⁶ On designated highways; trucks 26.5 feet and buses 30 feet.

²⁷ Class AA highways; 45 feet on other highways.

²⁸ Class AA highways only.

²⁹ Maximum gross weight on Class A highways 42,000 pounds.

³⁰ Including load 14 feet; various exceptions for vehicles.

³¹ Tandem axles spaced less than 48 inches apart by 4 feet.

³² Subject to axle and tabular limits.

³³ Single axle spaced less than 9 feet from nearest tandem axle.

³⁴ On designated highways only and limited to one trailer.

³⁵ On designated highways only.

³⁶ Administrative regulation—32,000 pounds allowed on 2 and 5 is 28 ft. or more.

³⁷ Semitrailer and semitrailer converted to full trailer by 4 feet.

³⁸ Dual-drive axles; otherwise 40,000 pounds.

³⁹ Or as prescribed by P.U.C.

⁴⁰ Exception for poles, pillings, structural units, etc.

WEIGHTS COMPARED WITH AASHO STANDARDS

December 31, 1961

Limit		Specified maximum gross weight—pounds ⁴						Practical maximum gross weight—pounds ⁵						Line
Applicable to:		Truck		Truck-tractor semitrailer			Other combination	Truck		Truck-tractor semitrailer			Other combination	
Any group of classes	Total wheel base only	2-axle	3-axle	3-axle	4-axle	5-axle		2-axle	3-axle	3-axle	4-axle	5-axle		
Over 18'	X	36,000	50,000	50,000	72,000	76,800	76,800	27,800	47,600	47,600	60,010	64,650	NP	1
Over 18'	Over 18'							26,000	40,000	44,000	58,000	72,000	76,800	2
Over 18'	Over 18'							26,000	40,000	44,000	58,000	72,000	76,800	3
Over 18'	Over 18'							26,500	40,500	45,000	59,000	65,000	65,000	4
Over 18'	Over 18'							26,000	40,000	44,000	58,000	72,000	76,000	5
X	X	30,000	46,000	50,000	60,000	60,000	NP	26,000	44,000	44,000	62,000	76,000	76,000	6
X	X	32,000	50,000	50,000	60,000	60,000	NP	30,848	44,720	51,000	61,200	61,200	NP	7
X	X	30,000	46,000	48,000	60,000	60,000	60,000	28,000	48,000	48,000	56,350	60,000	60,000	8
X	X							30,000	46,000	52,000	⁵⁴ 58,450	⁵⁴ 61,490	⁵⁴ 64,650	9
X	X						63,280	30,000	52,000	52,000	65,200	73,095	73,095	10
X	X							28,340	48,680	48,680	63,280	63,280	63,280	11
X	X							32,000	38,800	56,000	64,000	72,000	80,000	12
X	X							26,000	40,000	44,000	58,000	73,280	76,800	13
X	X	36,000	²² 41,000	45,000	59,000	72,000	72,000	26,000	40,000	44,000	58,000	72,000	72,000	14
X	X							27,000	41,000	45,000	59,000	²³ 73,000	²³ 73,000	15
X	X							26,540	40,960	45,080	59,500	73,280	NP	16
X	X							26,000	40,000	44,000	55,470	73,280	73,280	17
X	X	36,000	50,000	54,000	59,640	73,280	NP	26,900	41,600	45,800	59,640	73,280	NP	18
X	X	32,000	³⁰ 51,800	51,800	60,050	70,550	70,550	26,000	40,000	44,000	58,000	72,000	76,000	19
X	X							30,000	40,000	51,800	62,040	70,550	70,550	20
X	X							30,400	48,000	52,800	65,000	65,000	65,000	21
X	X	³² 46,000	³² 73,000	³² 73,000	³² 73,000	³² 73,000	NP	30,400	53,500	64,300	73,000	73,000	NP	22
X	X							26,000	³⁵ 40,000	44,000	³⁵ 58,000	³⁵ 66,000	³⁵ 102,000	23
X	X							26,000	40,000	44,000	58,000	³⁶ 72,000	³⁵ 72,500	24
X	X							26,000	³⁵ 40,000	44,000	59,000	³⁵ 64,650	³⁵ 64,650	25
X	X							26,000	40,000	44,000	55,470	64,650	64,650	26
Over 18'	Over 18'	36,000	54,000	54,000	71,146	71,146	71,146	26,000	40,000	44,000	58,000	72,000	76,000	27
Over 18'	Over 18'							26,780	41,200	45,320	59,740	73,280	73,280	28
Over 18'	Over 18'							26,900	41,600	45,800	60,500	75,200	76,800	29
Over 18'	Over 18'	33,400	³⁸ 47,500	52,800	66,400	60,000	60,000	30,400	44,000	52,800	66,400	66,400	66,400	30
Over 18'	Over 18'	30,000	40,000	60,000	60,000	60,000	60,000	31,500	41,600	55,040	63,000	63,000	63,000	31
Over 18'	Over 18'							29,600	42,320	51,200	63,920	76,640	86,400	32
Over 18'	Over 18'							30,400	44,000	52,800	65,000	65,000	65,000	33
Over 18'	Over 18'	31,500	46,200	46,200	65,100	65,100	65,100	27,000	46,000	46,000	65,100	65,100	65,100	34
Over 18'	Over 18'							26,000	38,000	44,000	56,000	⁴⁴ 64,000	⁴⁴ 64,000	35
Over 18'	Over 18'							27,000	39,500	46,000	58,500	71,000	78,000	36
Over 18'	Over 18'							26,000	40,000	44,000	58,000	72,000	73,280	37
Over 18'	Over 18'	33,000	47,000	50,000	60,000	⁴⁸ 76,000	⁴⁸ 76,000	26,000	40,000	44,000	58,000	72,000	⁴⁸ 76,000	38
Over 18'	Over 18'							31,072	45,080	51,500	61,800	61,800	63,860	39
Over 18'	Over 18'	⁵⁰ 36,000	⁵¹ 44,000	⁵² 50,000	¹³ 60,000	60,000	88,000	30,400	44,000	50,000	60,000	60,000	88,000	40
Over 18'	Over 18'													41
X	X							28,000	40,000	48,000	60,000	66,839	71,115	42
X	X							26,000	40,000	44,000	58,000	72,000	73,280	43
X	X							26,000	40,000	44,000	58,000	61,580	43,500	44
X	X							26,900	41,600	45,800	60,500	75,200	75,600	45
X	X	^{55a} 32,000	^{55b} 55,000	^{55c} 52,800	^{55d} 66,400	^{55d} 66,400	^{55d} 66,400	26,000	41,000	44,000	59,000	74,000	79,900	46
X	X							³⁵ 56,800	40,000	44,000	56,800	56,800	56,800	47
Over 18'	Over 18'	28,000	36,000	46,000	60,000	68,000	72,000	26,000	36,000	44,000	60,000	68,000	72,000	48
Over 18'	Over 18'													49
X	X				⁶⁶ 70,000	⁶⁶ 70,000	⁶⁶ 70,000	26,900	41,600	45,800	57,844	63,840	63,840	50
X	X							27,500	40,000	47,000	59,500	73,000	73,000	51
X	X							26,000	44,000	44,000	62,000	73,950	73,950	52
X	X							26,000	40,000	44,000	55,470	61,490	71,900	
20	18							29	27	29	49	46	27	
								22	20	22	2	1	0	
								0	4	0	0	4	24	

⁴¹ On designated highways 102 inches.
⁴² Trackless trolleys and buses 7 passengers or more, P.S.C. certificate 40 feet.
⁴³ Including front and rear bumpers.
⁴⁴ Vehicles in excess may be operated under special permit obtained in advance from the Department of Motor Vehicles.
⁴⁵ Auto transports only, by special permit only.
⁴⁶ 60 feet allowed truck tractor semitrailer on designated major routes.
⁴⁷ Logging vehicles permitted 7-foot wheelbase tolerance, 19,000-pound single axle, 34,000-pound tandem axle.
⁴⁸ Governs gross weight permitted on highways designated by resolution of State highway commission or by permit, otherwise 73,280.
⁴⁹ Single unit truck with 4 axles permitted 60,000 pounds.
⁵⁰ Axles spaced less than 6 feet 32,000 pounds; less than 12 feet 36,000 pounds; 12 feet or more gross weight governed by axle limit.
⁵¹ Single vehicle with 3 or more axles spaced less than 16 feet 40,000 pounds; less than 20 feet 44,000 pounds; 20 feet or more governed by axle limit.
⁵² Tractor semitrailer with 3 or more axles spaced less than 22 feet 46,000 pounds; not less than 27 feet 50,000 pounds.
⁵³ Limited to 3,500 pounds.
⁵⁴ Pavements only, maximum legal load for bridges 56,800 pounds.
⁵⁵ On Interstate Routes: a. 30,000 lbs.; b. 40,000 lbs.; c. 50,000 lbs.; d. 60,000 lbs.
⁵⁶ Where truck-tractor is properly registered in Pennsylvania, 55 feet.
⁵⁷ Vehicles registered before July 1, 1956, permitted limits in effect January 1, 1956, for life of vehicle.
⁵⁸ Three-unit combinations and full truck and full trailer combinations on designated highways.
⁵⁹ House trailers only.
⁶⁰ Axle load 21,000 pounds on 2-axle trucks hauling peeled or unpeeled forest products cut crosswise or transporting milk from farm to market but not over Interstate system.
⁶¹ On Class A highways. All axles of a vehicle or combination—73,000 pounds maximum. Wheel, axle, axle group and gross vehicle weights on Class B highways are 60% of weights authorized for Class A highways.
⁶² Based on ruling of Attorney General.
⁶³ Weight limits to be established by administrative regulations.
⁶⁴ For axle spacing under 8 feet.
⁶⁵ Weights are established on axle spacing of the extreme of any group.
⁶⁶ Only on certain highways, or portions thereof, designated by State Roads Commissioner, and consistent with Congressional action.

Economic Evidence in Right-of-Way Litigation

(References continued from p. 35)

prohibiting the use of medical works as direct evidence in the courtroom, except in certain specified cases authorized by statutes. S. C. Code § 26-142 (1952); Mass. Gen. Laws Ann. ch. 233 § 79C (1958); and Nev. Rev. Stat. § 51.040 (1960).

(160) See reference 132; Sprowls, *The Admission of Sample Data into a Court of Law. A Case History*, 4 U.C.L.A. L. Rev. 222 (1957); McCoid, *The Admission of Sample Data into a Court of Law: Some Further Thoughts*, 4 U.C.L.A. L. Rev. 233 (1957); Note, *Public Opinion Surveys As Evidence*, 66 Harv. L. Rev. 498 (1953); Note, *Admissibility of Public Opinion Polls*, 37 Minn. L. Rev. 385 (1953).

(161) 6 Wigmore, *Evidence*, § 1698 (3d ed. 1940).

(162) McCoid, reference 160, Note 37, pp. 223-24. Interested readers are referred to the following publications for detailed studies on survey and poll methodology: Parten, *Surveys, Polls and Public Opinion* (1949); Cantril, *Gauging Public Opinion* (1947); Blankenship, *Consumer and Opinion Research* (1954); see the reference guide of Smith, Lasswell, and Casey, *Propaganda, Communication and Public Opinion* (1946). For a discussion of the courts' attitude toward the methodology of the making of surveys or public opinion polls, see Annot., 76 A.L.R. 2d 619, 633-40.

(163) McCoid, reference 160.

(164) *United States v. 88 Cases*, 187 F. 2d 967 (3d Cir.), cert. den., 342 U.S. 861 (1951); *Hermann v. Newark Morning Ledger Co.*, 1 N.J. Super. 420, 138 A. 2d 61 (1958). See also reference 160, Note 6; 66 Harv. L. Rev., 498 (1953).

(165) *Gulf Oil Corp. v. F.T.C.*, 150 F. 2d 106 (5th Cir. 1945); Sorensen & Sorensen, *Responding to Objections Against Public Opinion-Survey Findings in the Courts*, 2 J. Marketing 195 (1955); see generally Barksdale, *Use of Survey Research as Legal Evidence* (1957); Caughey, *The Use of Public Polls Surveys and Sampling as Evidence in Litigation and Particularly Trademark and Unfair Competition Cases*, 44 Calif. L. Rev. 539 (1956); Hall, *Evidence-Hearsay-Admissibility of Public Surveys in Unfair Competition Cases*, 46 Trade-mark Rep. 154 (1956); Kecker, *Admission in Courts of Law of Economic Data Based on Samples*, 28 J. Bus. 118 (1955); Note 20, Geo. Wash. L. Rev. 211 (1951); Note 66, Harv. L. Rev. 498 (1953); Annot., 76 A.L.R. 2d 619 (1951).

(166) *United States v. United Shot Mach. Corp.*, 93 F. Supp. 196 (D. Mass. 1950); *United States v. J. I. Case Co.*, 101 F. Supp. 856 (D. Minn. 1951); but see *United States v. E. I. Dupont de Nemours & Co.*, 177 E. Supp. 1 (D. Ill. 1959).

(167) *RKO Radio Pictures v. Jarrico*, 128 Calif. App. 2d 172, 274 P. 2d 928, cert. denied, 349 U.S. 928 (1954); *Las Vegas Sun v. Franklin*, 74 Nev. 282, 329 P. 2d 867 (1958); *Great Atlantic & Pacific Tea Co. v. A. & P. Trucking Corp.*, 51

N. J. Super. 412 144 A. 2d 172 (1958), modified on other grounds, 29 N. J. 455, 149 A. 2d 595 (1959). Dean, *Sampling to Produce Evidence on Which the Courts will Rely*, Current Bus. Studies No. 19, p. 6 (1954).

(168) In *Repouille v. United States*, 165 F. 2d 152, 153 (2d Cir. 1947), Judge Learned Hand stated that the courts have no Gallup poll to aid them in discovering the meaning of the "good moral character," required of any applicant for naturalization; a poll is a possible method for verifying a position as to moral justifiability of an act performed by an applicant for naturalization.

(169) Survey methods may be used to discover whether there is sufficient local prejudice to justify a change of venue in criminal cases. See Note 54, Harv. L. Rev. 679, 684 (1941); Sorensen, *The Role of Public Sentiment and Personal Prejudice in Jury Trials of Criminal Cases*, Ch. X (unpublished dissertation, the University of Chicago).

(170) Woodward, *A Scientific Attempt to Provide Evidence for a Decision on Change of Venue*, 17 Am. Sociol. Rev. 447 (1952).

(171) "Value is nothing more than the price for which property may be sold and the value of other like property is highly probative as to the value of the property in question In the commercial field there is no more commonly accepted method for ascertaining property values than by comparison with other property and the prices at which it is sold." *City of Los Angeles v. Cole*, 28 Calif. 2d 509, 521, 170 P. 2d 928, 934 (1946) (dissenting opinion). See 2 Wigmore, *Evidence*, § 463 (3d ed. 1940). Since comparison of similar property is necessary for valuation, survey methods could be used in accumulating and presenting in aggregate form data of comparable sales.

(172) McCoid, reference 160, p. 235.

(173) *United States v. 88 Cases*, 187 F. 2d 967 (3d Cir.), cert. denied, 342 U.S. 861 (1951); Dean, reference 167, p. 5.

(174) Sorensen & Sorensen, reference 165, p. 137.

(175) *Quaker Oats Co. v. General Mills, Inc.*, 134 F. 2d 429 (7th Cir. 1943); *Oneida, Ltd. v. National Silver Co.*, 25 N.Y.S. 2d 271 (Sup. Ct. 1940); cf. *Alexander Young Distilling Co. v. National Distillers Prod. Corp.*, 40 F. Supp. 748 (E.D. Pa. 1941).

(176) *Pretrial Practice in State Condemnation Cases for Highway Purposes*, by M. H. Naftalin, in *Highway Laws, 1961*, Highway Research Board Bulletin 294, pp. 15-30; for a bibliography of articles on pretrial procedure, see Report of Comm. on Condemnation and Condemnation Procedure, Municipal Law Section, A.B.A., 1960, at 153. In a condemnation proceeding, a number of economic facts may be stipulated; for instance, the severance damage case studies or the economic impact study findings could be stipulated as

factual materials to which there would be no objection. Thus, a struggle over the adequacy or inadequacy of the data may be avoided. In this fashion, solid, factual materials may be admitted on stipulation, thereby narrowing wide disparities in land estimates through the mutual agreement in use of research materials.

(177) Submitting such a report to opposing counsel does not include the work product of the proponent of the report. It is discoverable by the other side only if there are special circumstances that make it essential to the preparation of his case and in the interest of justice that the statements be produced for his inspection or copying. See *Hickman v. Taylor*, 329 U.S. 495 (1947); *Walsh v. Reynolds Metals Co.*, 15 F.R.D. 376 (D. N. J. 1954); see generally Luttrell, *Some Applicable Rules in the Trial of a Condemnation Case*, 28 Appraisal J. 213, 216 (1960).

(178) Kennedy, *Law and the Courts*, in *The Polls and Public Opinion*, pp. 92, 161 (1949); Comment, 30 Tex. L. Rev., pp. 112, 118 (1951).

(179) Kennedy reference 178, p. 101; Sorensen & Sorensen, reference 165, pp. 134 *et seq.*

(180) Barksdale, *Use of Survey Research Findings as Legal Evidence*, p. xiii (1957).

(181) *United States v. Magyar*, 273 F. 2d 412 (2d Cir. 1959); *State v. Hunter*, 270 Ala. 57, 116 So. 2d 383 (1959); *Arkansas State Highway Commission v. Addy*, 329 S.W. 2d 535 (Ark. 1959); *Arkansas State Highway Commission v. Huges*, 328 S.W. 2d 391 (Ark. 1959); *Skinner v. Polk County*, 250 Iowa 1264, 98 N.W. 2d 749 (1959); *Stortenbecker v. Iowa Power & Light Co.*, 250 Iowa 1073, 96 N.W. 2d 468 (1959); *Luecke v. State Highway Commission*, 186 Kans. 584, 352 P. 2d 454 (1960); *United Fuel Gas Co. v. Mauk*, 325 S.W. 2d 339 (Ky. 1959); *Mississippi State Highway Commission v. Peterson*, 117 So. 2d 452 (Miss. 1960); *Mississippi State Highway Commission v. Pittman*, 238 Miss. 402, 117 So. 2d 197 (1960); *Mississippi State Highway Commission v. Ellzey*, 237 Miss. 345, 114 So. 2d 769 (1959); *Mississippi State Highway Commission v. Taylor*, 237 Miss. 847, 116 So. 2d 757 (1959); *Clark County School Dist. v. Mueller*, 348 P. 2d 164 (Nev. 1960); *Allbro v. Vallone*, 158 P. 2d 571 (R.I. 1960); *State v. Coffield*, 328 S.W. 2d 916 (Tex. 1959); *Utech v. City of Milwaukee*, 9 Wis. 2d 352, 101 N.W. 2d 57 (1960).

(182) *Arkansas State Highway Commission v. Addy*, 329 S.W. 2d 535 (Ark. 1959); *United Fuel Gas Co. v. Mauk*, 325 S.W. 2d 339 (Ky. 1959); *Mississippi State Highway Commission v. Taylor*, 237 Miss. 847, 116 So. 2d 757 (Miss. 1959).

(183) *Clark County School Dist. v. Mueller*, 348 P. 2d 164 (Nev. 1960); *Allbro v. Vallone*, 158 A. 2d 571 (R.I. 1960); *Utech v. City of Milwaukee*, 9 Wis. 2d 352, 101 N.W. 2d 57 (1960).

APPENDIX I

States Whose Constitutions Require Compensation

Part A, For Taking Property by Eminent Domain

Alabama:¹ Ala. Const., art. 1, § 23.
Connecticut: Conn. Const., art. 1, § 11.
Delaware: Dela. Const., art. 1, § 8.
Florida: Fla. Const., Declar. of Rts., § 12.
Hawaii: Hawaii Const., art. 1, § 18.
Idaho: Idaho Const., art. 1, § 14.
Indiana: Ind. Const., art. 1, § 21.
Iowa: Iowa Const., art. 1, § 18.
Kansas:² Kans. Const., art. 12, § 4 (not applicable to the State or public corporations).
Kentucky: Ky. Const., § 13.
Maine: Maine Const., art. 1, § 21.
Massachusetts: Mass. Const., pt. 1, art. 10.
Maryland: Md. Const., art. 3, § 40.
Michigan: Mich. Const., art. 13, § 1.
Nevada: Nev. Const., art. 1, § 8.

New Hampshire:³ N.H. Const., pt. 1, art. 12 (by implication as construed, *Great Falls Mfg. Co. v. Vernald*, 47 N.H. 444, 455 (1867)).

New Jersey: N.J. Const., pt. 20, art. 1.

New York: N.Y. Const., art. 1, § 7.

Ohio: Ohio Const., art. 1, § 19.

Oregon: Oreg. Const., art. 1, § 18.

Pennsylvania:⁴ Pa. Const., art. 1, § 10.

Rhode Island: R.I. Const., art. 1, § 16.

South Carolina: S.C. Const., art. 1, § 17.

Tennessee: Tenn. Const., art. 1, § 21.

Vermont: Vt. Const., ch. 1, art. 2.

Wisconsin: Wis. Const., art. 1, § 13.

Part B, For Taking or Damaging Property by Eminent Domain

Alabama:⁴ Ala. Const., art. 12, § 235 (where a municipal or other corporation is condemning).

Alaska: Alaska Const., art. 1, § 18.

Arizona: Ariz. Const., art. 2, § 17.

Arkansas: Ark. Const., art. 2, § 22.

California: Calif. Const., art. 1, § 14.

Colorado: Colo. Const., art. 2, § 15.

Georgia: Ga. Const., art. 1, § 3, par. 1.

Illinois: Ill. Const., art. 2, § 13.

Kentucky:⁴ Ky. Const., § 242 (where a municipal or other corporation is condemning).

Louisiana: La. Const., art. 1, § 2.

Minnesota: Minn. Const., art. 1, § 13.

Mississippi: Miss. Const., art. 3, § 17.

Missouri: Mo. Const., art. 1, § 25.

Montana: Mont. Const., art. 3, § 14.

Nebraska: Nebr. Const., art. 1, § 21.

New Mexico: N. Mex. Const., art. 2, § 20.

North Dakota: N. Dak. Const., art. 1, § 14.

Oklahoma: Okla. Const., art. 2, § 24.

Pennsylvania:⁴ Pa. Const., art. 16, § 8 (where a municipal or other corporation is condemning).

South Dakota: S. Dak. Const., art. 6, § 13; S. Dak. Const., art. 17, § 18 (applicable to municipal and other corporations).

Texas: Tex. Const., art. 1, § 17.

Utah: Utah Const., art. 1, § 22.

Virginia: Va. Const., § 58.

Washington: Wash. Const., art. 1, § 8.

West Virginia: W. Va. Const., art. 3, § 9.

Wyoming: Wyo. Const., art. 1, § 33.

¹ Taking provisions applicable to all types of condemnation.

² No compensation provision applicable to the exercise of eminent domain by the State or a public corporation.

³ Compensation requirement merely has been deemed to be implied by a consent provision.

⁴ Taking or damaging provisions applicable to the exercise of eminent domain by the State or a public corporation.

Setoff Rules When a State or Local Government Takes Property for Highway Construction or Improvement

Part A, General and Special Benefits Against Value of Land Taken and Severance Damages

Alabama: ¹ Ala. Const., art. 1, § 23, as construed in *McRea v. Marion County*, 222 Ala. 511, 133 So. 278 (1931); Ala. Code Ann., tit. 19, § 14 (1940), but see Part B.

New Mexico: *Board of Commissioners v. Gardner*, 57 N.M. 478, 260 P. 2d 682 (1953).

North Carolina: N.C. Gen. Stat., § 136-19 (1958), as construed in *Barnes v. North Carolina State Highway Commission*, 250 N.C. 378, 109 S.E. 219 (1959).

South Carolina: ¹ S.C. Code, by §§ 25-165 (Supp. 1960), 33-127, 33-136 (1952), as amended; see generally *Smith v. City of Greenville*, 229 S.C. 252, 92 S.E. 2d 639 (1956).

Part B, Special Benefits Only Against Value of Land Taken and Severance Damages

Alabama² (highway improvements by local governments): Ala. Const., art. 12, § 223, as distinguished in *McRea v. Marion County*, 222 Ala. 511, 133 So. 278 (1931).

Arkansas Ark. Stat. Ann., § 76-521 (1947); *Ball v. Independence County*, 214 Ark. 694, 217 S.W. 2d 913 (1949).

Connecticut: Conn. Gen. Stat., § 13-145 (1958); *Sorenson v. Coz*, 132 Conn. 583, 46 A. 2d 125 (1946); *Schwartz v. City of New London*, 20 Conn. Supp. 21, 120A. 2d 84 (1955).

Delaware: ³ *State ex rel. State Highway Department v. Morris*, 47 Del. 477, 93 A. 2d 523 (Super. Ct. 1952).

Florida: Fla. Stat., § 73.10(3) (1957).

Hawaii:⁴ Hawaii Rev. Laws, § 8-21 (1955) (except in road widening or realignment cases); but see Part D.

Kansas: Kans. Gen. Stat., §§ 26-209, 68-706 (1949), as amended; *Trasper v. Board of Commissioners*, 27 Kans. 391 (1882).

Maine: *Boober v. Towne*, 127 Maine 332, 143 Atl. 176 (1928); *In re Penley*, 89 Maine 313, 36 Atl. 397 (1896).

¹ In certain cases, only special benefits may be setoff. See Part B.

² See Part A for general rule.

³ Setoff statutes seem to contain sufficiently broad language to authorize general benefit setoff, if and when they should be construed on this point.

⁴ In certain cases, setoff is allowed only against severance damages, see Part D.

Massachusetts: Mass. Gen. Laws Ann., ch. 79, § 12 (1958).

Michigan: ³ Mich. Stat. Ann., c. 64, § 8.189 (1958).

New Hampshire: *Whitcher v. Benton*, 50 N.H. 25 (1870).

New Jersey: *State v. Hudson County Board of Chosen Freeholders*, 55 N.J.L. 88, 25 Atl. 322 (1892).

Minnesota: *Chicago, R. I. and P. Ry. v. City of Minneapolis*, 164 Minn. 226, 205 N.W. 640 (1925).

Pennsylvania: ⁵ Johnson's Petition, 344 Pa. 5, 23 A. 2d 880 (1942).

Rhode Island: *D'Angelo v. Director of Public Works*, 152 A. 2d 211 (R.I. 1959).

South Carolina² (condemnation by county government): S.C. Code, § 33-840 (1952), as distinguished in *Smith v. City of Greenville*, 229 S.C. 252, 92 S.E. 2d 639 (1956).

South Dakota: ³ S.D. Code, §§ 28.13 A09, 37.4010 (Supp. 1960).

Vermont:⁵ Vt. Stat. Ann., tit. 19, § 221 (1959).

Washington: Wash. Rev. Code, §§ 8.04.080, 8.08.040, 8.12.190 (1961).

Part C, General and Special Benefits Against Severance Damages Only

New York: *Hartman v. State*, 5 Misc. 2d 636, 161 N.Y.S. 2d 748 (Ct. Cl. 1957); New York, *W & B Ry. v. Siebrecht*, 73 Misc. 219, 130 N.Y.S. 1005 (Sup. Ct. 1919).

Virginia: Va. Code Ann., § 33-73 (1950), as construed in *Long v. Shirley*, 117 Va. 401, 14 S.E. 2d 375 (1951).

West Virginia: W. Va. Code, § 5380 (1955) as construed in *Strouds Creek & M.R.R. v. Herald*, 131 W. Va. 45, 45 S.E. 2d 513 (1947).

Part D, Special Benefits Against Severance Damages Only

Alaska: ⁶ Alaska Comp. Laws Ann., § 57-7-13 (1949).

Arizona: ⁶ Ariz. Rev. Stat. Ann., § 12-1122 (1956), as construed in *Pima County v. De Concini*, 79 Ariz. 154, 285 P. 2d 609 (1955).

California: Calif. Civil Procedure Code, § 1248, as construed in *People v. Schultz Co.*, 123 Calif. App. 2d 925, 268 P. 2d 117 (1954).

⁶ Setoff against full value is implied from the use of the before-and-after formula in these jurisdictions.

⁶ Although not yet so construed, these statutes are identical to the California provision, which is limited to special benefits.

Colorado: Colo. Rev. Stat., § 50-1-17 (1953); *Denver Joint Stock Land Bank v. Board of County Commissioners*, 105 Colo. 366, 98 P. 2d 283 (1940).

Georgia: Ga. Code Ann., § 36-504 (1933), as construed in *State Highway Board v. Bridges*, 60 Ga. App. 240, 3 S.E. 2d 907 (1939).

Idaho: Idaho Code, § 7-711 (1947).

Hawaii:⁷ Hawaii Rev. Laws, § 8-21 (1955) (in road widening or realignment cases only).

Illinois: Ill. Const., art. 2, § 13, as construed in *Kane v. City of Chicago*, 392 Ill. 172, 64 N.E. 2d 506 (1945); *Department of Public Works and Buildings v. Barton*, 371 Ill. 11, 19 N.E. 2d 935 (1939).

Indiana: Burns Ind. Stat. Ann., § 3-1706 (1946), as construed in *State v. Smith*, 237 Ind. 72, 143 N.E. 2d 666 (1957).

Kentucky: Ky. Rev. Stat., §§ 177.083, 416.100-416.120, 416.230-416.240 (1960); *Freuel v. Commonwealth*, 331 S.W. 2d 710 (1959).

Louisiana: *Louisiana Highway Commission v. Grey*, 197 La. 942, 2 So. 2d 654 (1941).

Maryland: Md. Ann. Code, art. 33A, § 25 (1957); *Pumphrey v. State Roads Commission*, 175 Md. 498, 2 A. 2d 668 (1937).

Mississippi: *Mississippi State Highway Commission v. Hillman*, 189 Miss. 859, 198 So. 565 (1940).

Missouri: Mo. Rev. Stat., § 227.120 (1959).

Montana: Mont. Rev. Code, § 99-9912 (1949), as amended. Nebraska: *Crawford v. Central Neb. Public Power & Irr. Dist.*, 154 Nebr. 832, 49 N.W. 2d 682 (1951).

Nevada:⁶ Nev. Rev. Stat., § 37.110 (1960).

North Dakota: N. Dak. Cent. Code, § 35-15-22 (1960), as construed in *Lineburg v. Sandoen*, 74 N. Dak. 364, 21 N.W. 2d 808 (1946).

Ohio: Ohio Const., art. 1, § 19; *In re Abraham*, 121 N.E. 2d 695 (Ohio Com. Pl. 1953).

Oregon: *State Highway Commission v. Bailey*, 212 Ore. 261, 319 P. 2d 906 (1957).

Tennessee: Tenn. Code Ann. § 23-1414 (1955).

Texas: Tex. Civ. Stat., art. 3265 (1952), as construed in *State v. Carpenter*, 126 Tex. 604, 89 S.W. 2d 194 (1936).

Utah: Utah Code Ann., § 104-61-11 (1943).

Wisconsin: Wis. Stat. Ann., § 32.09 (Supp. 1961).

Wyoming:³ Wyo. Stat., § 1-775 (1957).

Part E, Setoff Prohibited

Iowa: Iowa Const., art. 1, § 18.

Oklahoma: Okla. Const., art. 2, § 24.

⁷ See Part B.

(Appendix III appears on p. 40)

Motor Vehicle Size and Weight Limits

A comparison of State legal limits of motor-vehicle sizes and weights with standards recommended by the American Association of State Highway Officials is given in the table on pages 36-37. The statutory limits reported in this tabulation, prepared by the Bureau of Public Roads as of December 31, 1961, have been reviewed for accuracy by the appropriate State officials.

Statutory limits are shown for width, height, and length of vehicles; number of towed units; maximum axle loads for single and tandem axles; and maximum gross weights for single-unit truck, truck-tractor semitrailer combinations, and other combinations.

APPENDIX III

Admissibility of Comparable Sales as Evidence of Market Value in Condemnation Proceedings

Part A, Independently Admissible as Evidence of Market Value

Alabama: *Southern Elec. Generating Company v. Leibacher*, 269 Ala. 9, 110 So. 2d 308 (1959).
 Arizona: *Town of Williams v. Perrin*, 70 Ariz. 157, 217, P. 2d 918 (1950).
 Arkansas: *Sewer & Water Works Improvement Dist. No. 1 v. McClendon*, 187 Ark. 510, 60 S.W. 2d 920 (1933).
 California: *County of Los Angeles v. Faus*, 48 Calif. 2d 672, 312 P. 2d 680 (1957).
 Colorado: *Kistler v. Northern Colo. Water Conservancy Dist.*, 126 Colo. 11, 246 P. 2d 616 (1952).
 Connecticut: *Campbell v. City of New Haven*, 101 Conn. 173, 125 A.L. 650 (1924).
 Delaware: *Wilmington Housing Authority v. Harris*, 47 Del. 169, 6 A. 2d 518 (Super. Ct. 1952).
 Florida: *City of Tampa v. Texas Company*, 107 So. 2d 216 (Fla. App. 1958).
 Georgia: *Flemister v. Central Ga. Power Company*, 140 Ga. 511, 79 S.E. 148 (1913); *Fulton County v. Cox*, 109 S.E. 2d 849 (Ga. App. 1959).
 Illinois: *City of Chicago v. Blanton*, 15 Ill. 2d 198, 154 N.E. 2d 342 (1958).
 Indiana: *Anderson Ind. Pub. Serv. Company v. Darling*, 230 Ind. 277, 53 N.E. 2d 881 (1958).
 Iowa: *Iowa State Highway Commission*, 251 Iowa 332, 90 S.W. 2d 113 (1959).
 Kansas: *Wood v. Syracuse School Dist.*, 108 Kans. 1, 193 P. 2d 392 (1950).
 Kentucky: *Stewart v. Commonwealth*, 337 S.W. 2d 880 (Ky. 1960).
 Louisiana: *State v. Harvard*, 239 La. 133, 118 So. 2d 131 (1960).
 Maryland: *Patterson v. Mayor & City Council of Baltimore*, 127 Md. 383, 56 Atl. 458 (1915).
 Massachusetts: *Epstein v. Boston Housing Authority*, 317 Mas. 297, 58 N.E. 2d 135 (1944).
 Missouri: *State v. Bruening*, 326 S.W. 2d 305 (Mo. 1959).
 Nebraska: *Lanadon v. Loup River Public Power Dist.*, 142 Nebr. 859, 8 N.W. 2d 201 (1943).

New Hampshire: *Eames v. Southern N.H. Hydro-Elect. Corp.*, 85 N.H. 379, 159 Atl. 128 (1932).
 New Jersey: *Curley v. Mayor & Aldermen of Jersey City*, 83 N.J.L. 760, 85 Atl. 197 (E. & A. 1912); *State v. Williams*, 65 N.J. Super. 518, 168 A. 2d 233 (App. Div. 1961).
 New York: *Village of Lawrence v. Greenwood*, 300 N.Y. 231, 90 N.E. 2d 53 (1949).
 Oregon: *State v. Parker*, Oreg., 357 P. 2d 548 (1960).
 Tennessee: *Union Ry. v. Hunton*, 114 Tenn. 609, 88 S.W. 182 (1905).
 Texas: *City of Austin v. Canizzo*, 153 Tex. 324, 267 S.W. 2d 808 (1954).
 Utah: *State v. Peek*, 1 Utah 2d 263, 265 P. 2d 630 (1953).
 Virginia: *May v. Dewey*, 201 Va. 621, 112 S.E. 2d 838 (1960).
 Washington: *Seattle & M. Ry. v. Gilchrist*, 4 Wash. 509, 30 Pac. 738 (1892).
 Wisconsin: *Blick v. Ozaukee County*, 180 Wis. 45, 192 N.W. 380 (1923).
 Wyoming: *Morrison v. Cottonwood Dev. Co.*, 38 Wyo. 190, 266 P. 117 (1928).

Oklahoma: *Durell v. Public Serv. Co.*, 174 Okla. 549, 51 P. 2d 517 (1935) (rule stated as dictum).
 Rhode Island: *Hervey v. City of Providence*, 47 R.I. 378, 133 A. 618 (1926) (issue of remoteness held properly decided by judge to exclude evidence; Massachusetts rule assumed to be determinative).
 South Carolina: *Wateree Power Co. v. Rion*, 113 S.C. 303, 102 S.E. 331 (1920) (seems to assure Mass. rule in holding that sales to condemnor, where only sales of comparable land available, were admissible); *South Carolina Highway Department v. Hines*, 234 S.C. 254, 107 S.E. 2d 643 (1959) (Gen. Rule recognized without indication whether it was S.C. law (evidence excluded, because as a mere offer not accepted, it was not within the rule).
 West Virginia: (No cases dealing with evidence of comparable sales to noncondemnor); cf. *United Fuel Gas Co. v. Allen*, 137 W. Va. 897, 75 S.E. 2d 88 (1953) (sale to condemnor voluntarily made is good where severance damages are not involved).

Part B, Admissible in Support of Opinion Testimony

District of Columbia: *District of Columbia Redev. Land Agency v. 61 Parcels of Land*, 98 U.S. App. D.C. 367, 235 F. 2d 864 (1956) (admissible to support appraiser's expert testimony but subject to the court's discretion).
 Mississippi: *Mississippi State Highway Commission v. Rogers*, 236 Miss. 800, 122 So. 2d 250 (1959).
 Ohio: *In re Ohio Turnpike Commission*, 164 Ohio St. 377, 131 N.E. 2d 397 (1955), cert. denied, 352 U.S. 806 (1957).

Part C, Judicial Indication That it Would be Independently Admissible Though Never so Held

Nevada: *Clark County School Dist. v. Mueller*, 76 Nev. 11, 348 P. 2d 164 (1960) (dictum for such evidence).

Part D, Admissible Only to Impeach Opinion Testimony

Michigan: *Lockeman v. Dillman*, 255 Mich. 152, 237 N.W. 552 (1931).
 Minnesota: *Minneapolis-St. Paul Sanitary Dist. v. Fitzpatrick*, 201 Minn. 442, 277 N.W. 394 (1937).
 North Carolina: *Templeton v. State Highway Commission*, 118 S.E. 2d 918 (N.C. 1961).
 Pennsylvania: *Serals v. West Chester Borough School Dist.*, 292 Pa. 134, 140 Atl. 632 (1928).

Part E, No Cases in Point

Alaska, Hawaii, Idaho, Maine, Montana, New Mexico, North Dakota, South Dakota, Vermont.

APPENDIX IV

An Example of the Determination of General and Special Benefits

In figure 1:
 Town X, with residential lots *a* and *b*, represents a hypothetical town affected by a new highway bypassing it.
 Town Y, with residential lots *c* and *d*, represents a hypothetical town that is comparable to town X but not affected by new highway construction.

Benefits from Highway Improvement

Each of the four residential lots was valued at \$1,000 prior to construction of the new highway bypass. After construction of the bypass, in town X, lot *a* had a value of \$1,400 and lot *b* had a value of \$1,200. In town Y, the value of lots *c* and *d* remained unchanged at \$1,000 each. The change in value of lots in town X illustrates benefits of increased property values derived from construction of a new highway.
 Property values in town X increased an average of \$200 per lot following the opening of the bypass but no increase in property values occurred in the control town of Y. The average increase in value of \$200 represents a general benefit for each of the lots *a* and *b*, \$1,200 minus \$1,000.

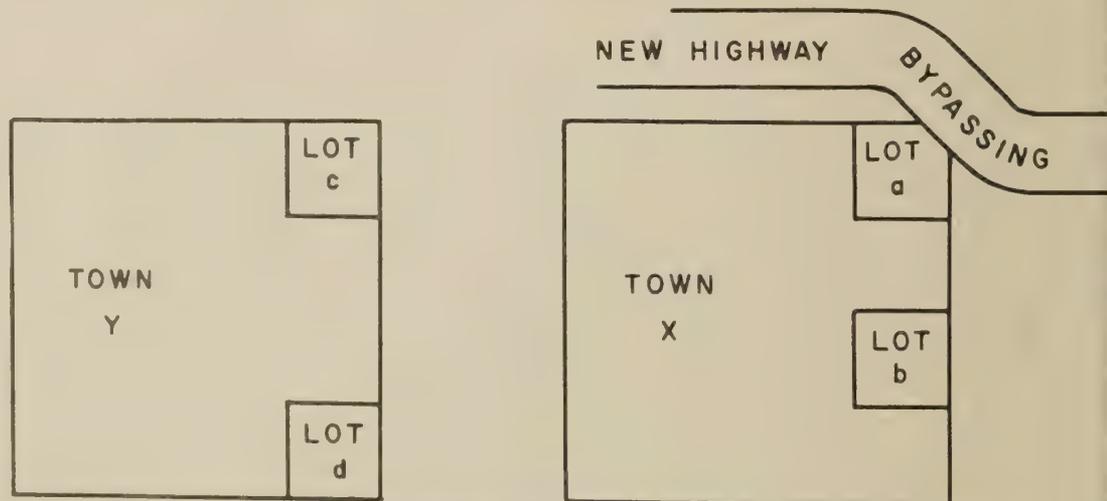


Figure 1.—Hypothetical towns and lots used to illustrate benefits from a highway improvement.

Within town X, lot *a*, which was partially taken for highway right-of-way, was affected by the highway construction to a greater extent than lot *b*, a comparable lot within the same community. After the opening of the highway, lot *a* sold for \$1,400—thus, a special benefit of \$200 accrued to lot *a*, the difference between \$1,400 and \$1,200.

For the purpose of determining benefits accruing to lot *a*, the control for special benefits is lot *b*; for general and special benefits, the control is either lot *c* or *d*.

(Appendix V appears on pp. 42-43)

NEW PUBLICATIONS

Four recent publications by the Bureau of Public Roads are now available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at the prices indicated for each.

Aggregate Gradation for Highways

Aggregate Gradation for Highways (25¢), contains two important articles on this subject: *Aggregate Gradation: Simplification, Standardization, and Uniform Application*, by a special committee of experts in the Bureau of Public Roads, and *A New Graphical Chart for Evaluating Aggregate Gradation*, by J. F. Goode and L. A. Lufsey.

The first article points out the need for simplification, standardization, and uniform application of aggregate gradation specifications in the highway field, noting the benefits that would result from reduction from their present extreme diversity. It explains the value of the simplified practice recommendation system for aggregate gradation, which provides a reasonably limited number of standard specifications and uniformity in the number and sizes of sieves for use in specifying these gradations. The article discusses the existing AASHO and ASTM standard aggregate specifications and recommends their universal adoption, recognizing that non-conforming gradations may be necessary as special provisions or supplemental specifications.

The second article describes the development of a new aggregate gradation chart using for its horizontal scale a power function rather than the logarithm of the sieve openings. With this chart, maximum density curves plot as a straight line from zero percent passing zero theoretical sieve size to 100 percent at the maximum size, rather than the difficult-to-define, deeply sagging curves obtained by plotting on the customary gradation chart.

The article demonstrates the value of the new chart in developing realistic specifications and in evaluating individual gradations, using as examples both actual field problems and laboratory experiments.

America's Lifelines—Federal Aid for Highways

America's Lifelines—Federal Aid for Highways (15¢), a colorful, illustrated leaflet, describes in simple terms the Federal-aid highway program and the functions of the Bureau of Public Roads. Information is included on the 41,000-mile National System of Interstate and Defense Highways (and a map of the system) and on the Federal-aid program for the improvement of the more extensive Federal-aid primary and secondary systems. Also described are the Bureau of Public Roads activities in roadbuilding on Federal lands, providing engineering services to other Federal agencies, highway planning, research, safety, and assistance to foreign governments in organizing highway departments and launching road improvement programs.

Increasing the Traffic-Carrying Capability of Urban Arterial Streets

Increasing the Traffic-Carrying Capability of Urban Arterial Streets (40¢), reported by Arthur A. Carter, Jr., describes a pilot study conducted by the Bureau of Public Roads of the traffic improvements that could be made on an urban arterial street, working within the existing right-of-way limits. The study was made in Washington, D.C., and has often been referred to as "The Wisconsin Avenue Study." The forepart of the publication reviews every known, practical means of improving traffic movements on an arterial street. Application was then made (in

theory) of these means, singly and in combination, to provide a traffic stream having maximum capacity and minimum friction while at the same time providing conditions conducive to patronage of the adjacent land services. Three phases were entailed, the first involving little or no cost, the second requiring moderate cost and some construction, and the third calling for major expenditures. The calculated effects of the theoretical ultimate improvements would have permitted peak-hour traffic volume increases of 100 to 200 percent and increases in average speed from 14-20 to 25-30 miles per hour. The publication is not intended to be a manual, but should serve as an invaluable guide to highway and traffic engineers.

Manual for Highway Severance Damage Studies

The *Manual for Highway Severance Damage Studies* (\$1.00) was prepared by the Highway and Land Administration Division, Bureau of Public Roads, in 1961, to serve as a guide particularly for use by the State highway departments. Widespread subsequent interest indicated the desirability of making the manual available through the Government Printing Office. Partial takings of property for highway right-of-way frequently involve severance damages which, without sufficient comparable information, are often difficult to evaluate. This manual calls attention to the value of information about actual experience in individual severance damage cases, and describes in some detail systematic methods of collecting, processing, and analyzing such information. A large body of facts on this subject will provide an invaluable reference "bank," both for economic research studies and for use in making and supporting sound appraisals of severance damages in actual right-of-way taking cases.

Errata

In the April 1962 issue of PUBLIC ROADS, vol. 32, No. 1, an error appears in the legend for figure 6, page 7, of the article, *Social Effects of Modern Highway Transportation*. The correct identification for the university in the center of the illustration is: University of Kansas City, Kansas City, Mo.

APPENDIX V

Status of Severance Damage Studies ¹

(As of September 1, 1961)

State	Research agency	Nature of study in progress	Studies completed
Alabama ²	Alabama State Highway Department.	Case studies of severance damages.	
Arizona ²	Arizona Highway Department.	Analysis of cost data in connection with the acquisition of right-of-way for highway improvements.	
Arkansas ²	Arkansas State Highway Commission.		
California.	California Division of Highways.	Continuing case studies of severance damages to remainder properties after partial takings for right-of-way.	<i>Land Economic Studies, Remainder Parcel Analysis No. 1</i> —summarizes 10 remainder parcel sales in Vallejo, Calif. <i>Land Economic Studies</i> —summarizes 20 remainder parcel cases. <i>California Land Economic Studies—Techniques</i> . <i>Remainder Parcels</i> , a report of the Land Economics Study Section.
Colorado.	Colorado Department of Highways.	Severance damages, right-of-way acquisition, and partial takings, including case studies of same.	<i>Case Studies of Damage Payments</i> , Nos. 1 through 21.
Florida ²	Florida State Road Department.		
Georgia ²	Georgia State Highway Department.	Analysis of factual evidence with respect to values fixed, payments made, disposition of remainder properties, and use of remainder properties.	
Hawaii ²	Hawaii Department of Transportation, Division of Highways.		
Idaho.	Idaho Department of Highways.	Analysis of actual damage as compared with damage awards in connection with right-of-way takings.	
Illinois.	University of Illinois.	Case studies of land values and severance damages to remainder properties after partial takings for right-of-way.	<i>Land Economic Studies</i> , Nos. 1-5.
Indiana.	Indiana State Highway Department.	Evaluation of right-of-way appraisal values and determination of a series of basic uniform rules and guides to be used in land appraisals.	
Iowa.	Iowa State Highway Commission.	Effects of farm unit severance resulting from right-of-way purchase.	
Kansas.	State Highway Commission of Kansas.	Severance damage studies as part of a larger economic impact study.	
Kentucky ²	Kentucky Department of Highways.	Investigation and evaluation of damage effects in terms of market value of a highway building program on remainders of partial takings in urban and rural areas.	
Louisiana ²	Louisiana Department of Highways.		
Maine.	Maine State Highway Commission.	Case study of partial taking and severance damage.	
Maryland.	Maryland State Roads Commission.	Case studies of remainder properties after purchase for right-of-way.	
Michigan.	Michigan State Highway Department.	Guide for right-of-way appraisers in estimating costs for property acquired for highway right-of-way.	<i>Land Economic Studies</i> , Nos. 1-7.
Minnesota.	University of Minnesota.	Relationships between compensation payments and the extent of the property taken plus damages as a direct consequence of the highway.	<i>How Farmers Adjusted to an Interstate Highway in Minnesota</i> .
	Minnesota Department of Highways.	Analysis of severance damages as part of an economic impact study being made on a segment of I-094-3(15) in St. Paul.	
Mississippi.	University of Mississippi.	Analysis of effects on land use, land value, and fragmentation. Case studies of partial takings of rural properties.	
Missouri.	Missouri State Highway Commission.	Severance damage studies being conducted as part of a larger economic impact study.	
Montana ²	Montana State Highway Commission.		

See footnotes at end of table.

APPENDIX V—Continued

Status of Severance Damage Studies¹

State	Research agency	Nature of study in progress	Studies completed
Nebraska ²	Nebraska Department of Roads		
New Jersey	New Jersey State Highway Department.	Develop data in order to provide a more reliable basis for estimating severance and consequential damage.	<i>Severance Study Manual.</i>
New Mexico	New Mexico State Highway Commission.	Severance damage studies	
New York	New York Department of Public Works.	Severance damage studies being conducted as part of the Northway economic impact study.	
North Carolina ²			
North Dakota ²	North Dakota State Highway Department.	Case studies of several sections of highway	
Ohio	Ohio Department of Highways	Studies of land values and relationship of subsequent sales prices of remainder parcels to "before" value, by type of remainder parcels.	
Oklahoma	Oklahoma State Highway Department.	Collection and interpretation of sales data on severed parcels of land previously acquired. These data are expected to provide a basis for right-of-way appraisers to substantiate "after" values in the "before and after" appraisals for highway right-of-way.	
Oregon	Oregon State Highway Commission	Case studies of land values and severance damages to remainder properties after partial takings for right-of-way.	<i>Land Economic Studies Properties Abutting Baldock Freeway.</i> <i>Oregon Land Economic Studies, Nos. 30-35.</i>
South Carolina ²	University of South Carolina	Severance damage studies being conducted as part of a larger economic impact study.	
South Dakota	South Dakota Department of Highways.	Parcel by parcel analysis of remainder properties adjacent to completed segments of the Interstate System to determine effects of the facility on (1) the market value of remaining land, and (2) the development of the remaining land.	
Tennessee	University of Tennessee	Severance damage studies being conducted as part of a larger economic impact study.	
Utah ²	Utah State Road Commission		
Texas	Texas Transportation Institute, Texas A and M College.	Various aspects connected with the acquisition of right-of-way for highway use, including studies of case histories of remainder parcels and effects of displacement of persons and investments resulting from right-of-way acquisitions.	
Vermont	Vermont Department of Highways	Provide a more reliable basis for estimating severance and consequential damage.	
Virginia	Virginia Department of Highways		A number of case histories have been completed.
Washington	Washington Department of Highways.	Analyze value of remainder properties after purchase of portion for highway use; case studies.	Individual land economic studies Nos. 1-28, 34, 36, and 41.
Wisconsin ²	Wisconsin State Highway Commission.		
Wyoming ²	Wyoming State Highway Commission.		
Nationwide	Agricultural Research Service, U.S. Department of Agriculture.		<i>The Effects on Farm Operating Units of Partial Taking for Controlled-Access Highways.</i>

¹ In most cases, these severance damage studies are being conducted by researchers within the State highway departments, although in a few instances the work is being done under contract. For additional information concerning any study, it is suggested that inquiry be

made to the appropriate State highway department.

² In planning stage; others listed are underway.

Special Assessments in Theory and Practice

By **FLOYD I. THIEL**, Economist,
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Highway and Land Administration Division,
Bureau of Public Roads, and
H. RUSSELL BRIGGS,
Director, Economic Research Agency¹

Introduction

SPECIAL assessments are based on the principle of equity. The philosophy of the use of special assessments is that, the owner of property benefited by a public improvement should contribute toward the cost of the improvement, and taxpayers in general should not have to bear the expense of improvements of no particular advantage to them. The use of special assessments for financing certain public improvements such as highways or sewers is an indication that some local benefit can be attributed to the improvement. The principle that the owner of a property assessed is to receive a benefit corresponding to the amount assessed.² The extent of the local or special benefit may be confined to the land and buildings or it may extend beyond to noncontiguous property. In some instances, special assessments are used to finance public improvements affecting fairly large areas, for example, an entire city or several counties.

Special assessments, which may be imposed by central government bodies and/or special assessment districts, differ from general property taxes in several ways. Special assessments ordinarily apply to a more limited area and for a specified duration of time. The typical special assessment applies to a fairly small area for a period of time that is only as long as is required to pay for the specific improvement; however, special assessments are used to some extent to cover the costs for certain repetitive undertakings. Another difference peculiar to special assessments is that property owners often initiate the application of such taxes by requesting special improvements. The special assessment procedure also is distinguished from the general property tax by the requirements for public hearings and notification thereof to all property owners who would be affected by the special assessment.

Special assessments formerly were in common use for financing rural roads—they still are used to a considerable extent for streets—and this financing procedure made a considerable contribution toward the early building of State highways. At the present time, interest in the use of special assessments as a method of public financing is related to the indirect connection this procedure has to financing the

This article summarizes the report submitted on a study of the use of special assessments for financing public improvements and the relation of this type of financing to highway construction. The Bureau of Public Roads had this study made so that information could be presented to Congress on the special assessment procedure as an alternative method of financing highway construction. This study was conducted on a selective basis, and the utilization of the special assessment procedure was investigated in a restricted number of States by field investigations and through correspondence.

This summarization includes information on: The historical use of special assessment financing, the legal justification for use of this method in the United States, the prevalence of the use of the special assessment procedure, some of the purposes for which this type of financing is used, and some of the problems related to an equitable levying of special assessments, especially for highway construction.

Nation's network of highways. The chief significance in the use of the special assessment procedure lies in the fact that it is a well-established and judicially sustained procedure for financing public investments by levies on property, with such levies designed to be in proportion to the benefits to be received from the improvement thus financed. A clear precedent, predating the practice of road-user taxation, has been established for taxation of the so-called nonuser in proportion to the benefits he will receive. Because of its past use for financing highways, the special assessment procedure was among those for which the Bureau of Public Roads gathered information in carrying out its responsibility to provide the Congress with information about alternative methods of highway financing in the highway cost allocation study.

Historical Background

Special assessments to pay the cost of public improvements that provided benefits for certain property are known to have been used as early as the 13th century in England, and the procedure may have been used even earlier. By 1800, use of the special assessment had become firmly entrenched as part of the American system of public financing; however, there has not been complete agreement as to the constitutional bases for use of this procedure.

When the right to levy special assessments first was tested judicially, some courts ruled that, as the procedure had become so inherent a part of the American system of public finance, the imposts should be sustained in the public interest. Other courts justified the use of special assessments on the basis that the authority to levy them was a right of eminent domain, a position that soon was abandoned.

Currently, special assessments for public improvements that enhance the value of real property are being levied under the taxing power. Assessments for improvements deemed necessary for the public's health and safety, however, are justified as a manifestation of the police power; a principle accepted after abandonment of the position on the right of eminent domain. Special assessments for financing repetitive public undertakings, such as for sidewalks and sewers, also may be sustained under the taxing power but, because in theory assessments for such purposes are levied primarily to abate a nuisance, they are justified more properly as manifestations of the police power.

Advantages and Disadvantages

As a means for financing public improvements, the special assessment levy has both advantages and disadvantages—some aspects of the procedure might be regarded as either or both. As special assessments generally are not subject to tax or bonded indebtedness limitations, a political entity may undertake a program for needed public improvements in situations where limitations on spending would not permit such improvements to be accomplished with general funds. Obviously, a procedure that permits financing of needed public improvements on a timely basis has certain advantages. At the same time, the possibility of overdevelopment through use of special assessment financing might prove to be disadvantageous—overdevelopment that might occur because of the absence of some of the limitations imposed on general fund financing. Other possible advantages and disadvantages attendant on the use of special assessment financing are discussed in the following paragraphs.

¹ This paper is a summarization of some of the more significant aspects of *Special Assessments in Theory and Practice*, a report prepared for the Bureau of Public Roads by the Economic Research Agency, Madison, Wis.

² *In re Mead*, 74 N.Y. 216.

Another advantage of the special assessment procedure is the feasibility of using it to levy charges for expensive facilities only against those affected, rather than against all taxpayers. Special assessments for such purposes generally originate at the request of, and/or have the approval of, those who will be called upon to meet the payments—the very essence of democracy. Because of rough terrain, poor drainage, low population densities, and other factors, the cost for public improvements such as streets or sewers may be particularly high in certain areas. Use of a special assessment to finance this type of work is considered equitable and advantageous. Special assessments also can be levied against religious, educational, charitable, and other types of property that are exempt from the general property tax. This feature of the special assessment procedure is regarded as an advantage insofar as providing money for public purposes is concerned.

Special assessment financing also is considered advantageous because its use permits completion of needed public improvements without causing year-to-year fluctuations in the general revenue taxation program. Thus, public improvements for a limited area can be financed without any impact on the general property taxes of an entire governmental unit. A further advantage attributed to special assessment financing is the compatibility of this procedure for use with other methods of financing, including the general property tax.

Perhaps the major disadvantage of special assessment financing is that facilities may be extended beyond reasonable and legitimate needs; this disadvantage was referred to previously in connection with fund limitations. Overextension of facilities poses a danger that payments may become delinquent, a danger that experience with special assessments has shown to be very real. During the rapid-growth period of the 1920's, special assessment financing was used to a considerable extent to meet the demand for improved roads and streets. Overexpansion and overdevelopment occurred in some areas and, in the late 1920's and during the 1930's, widespread delinquency on payments of special assessments existed. For example, out of \$17 million of special assessment bonds in Cleveland, Ohio, in 1929 delinquent payments totaled more than \$10 million. In California in 1936, of about \$63 million in special assessment bonds outstanding in Los Angeles County, payments were delinquent on more than a third; in San Diego County, nearly \$9 million out of about \$14 million of special assessment bonds were in a default status.

The difficulty related to equitably apportioning benefits to particular properties is considered a problem or disadvantage in the use of the special assessment procedure. While considerable ingenuity has been demonstrated in assigning benefit and special assessment amounts to particular properties, these levies are imposed mainly by rule of thumb and guesswork. The fairly common procedure of charging abutting owners more than owners whose property is somewhat removed from the facility has certain shortcomings, which are

obvious. In the case of a highway, for example, a property a block or more away may benefit as much as the property abutting the facility. In fact, property removed from the highway may sometimes benefit more than abutting property.

Additional disadvantages in the use of the special assessment procedure include the problems of administration; these problems have been suggested in the discussion on delinquent payments of special assessments. Special assessment levies commonly are made by local boards, which may lack the necessary administrative abilities. Because of this lack, and for other reasons—for example, borrowing for projects financed through special assessment procedures normally is quite expensive unless full faith and credit bonds are issued—special assessment financing may lead to inflated costs. Furthermore, presumably the costs of improvements enhancing property values eventually can be recovered automatically through the increased revenues obtained from general property taxes; consideration of this possibility may weigh against the use of special assessment procedures for financing certain improvements.

Use of Special Assessments

Some of the variations in the use of special assessment procedures have been referred to in foregoing paragraphs. The extent to which special assessments have been used has changed from year to year. Variations also have occurred in the use that different localities or areas make of special assessment financing, and considerable variety has been noted in the purposes for which special assessments have been and are being made.

The apogee of special assessment financing in the United States appears to have been reached in the 1920's. A marked decline in the use of special assessments began in the 1930's and continued until after World War II to about 1950. A general increase in the use of this method of financing public improvements began again with the 1950's, and the amount of revenue being raised by special assessments now equals that of the 1920's; however, this amount does not represent as high a percentage of total municipal revenues as was the case in the 1920's. During the middle 1950's, the relation of special assessments to general property taxes became quite stable, according to information compiled by the U.S. Census Bureau. With assessments spread on an *ad valorem* basis and those levied for continuing activities such as street maintenance and lighting excluded, revenue raised from special assessments during the period from 1954 through 1958 has averaged 2.5 percent of the revenues obtained from local property taxes.

Circumstances surrounding the use of special assessments vary from locality to locality. Wide variations have been found (1) in the method in which special assessments are levied, (2) in the size of the special assessment districts, and (3) in the extent to which various localities depend upon special assessments for the financing of public improvements.

Levying Special Assessments

A charge on a front foot basis appears to be the most common method employed in levying special assessments for public improvements such as streets or parks, with the charge often being higher for property near the facility. Some of the problems arising from the assumption that the amount of benefit accruing to a property varies directly with its proximity to the improvement or new facility were referred to previously. Attempts made to evolve an equitable basis for levying special assessments no doubt have been responsible for many of the additions introduced into special assessment procedures. Special assessments now are levied, quite commonly, on a combination of two or more factors, such as: (1) proximity to the facility, (2) frontage abutting the improvement, (3) frontage abutting a street within a specified area, (4) area of the property involved, (5) value of the property, (6) a fixed rate per lot or per other land parcel. In some instances, where major arterials are provided for only partially by special assessments, abutting property is charged only with the cost of providing normal paving, which is considered to be a 12-foot lane. In some cities such as Milwaukee, Wis., and Detroit, Mich., the special assessment levy is based on benefits that are assumed to apply to property that extends halfway to the next parallel street. In one mountainous section of Los Angeles where lots were irregular in shape, it was deemed more equitable to levy the special assessments in part on the value of the lots rather than on a frontage basis.

Sizes of Special Assessment Districts

The sizes of special assessment districts vary a great deal; the size generally is dependent on the extent of the supposed benefit and, therefore, on the nature of the improvement. Special assessment districts traditionally have been considered to abut the improvement being financed but, as previously noted, tradition often is not followed. In Omaha, Nebr., special assessments for a boulevard were levied against property three-fourths of a mile away. In Fremont, Nebr., the cost of a bridge was recovered by a special assessment levied against the entire town. Financing the Moffat Tunnel under the Continental Divide in Colorado involved the establishment of a special assessment district some 145 miles long that varied in width from 6 miles up to the width of an entire county, 40 miles or more.

Dependence on Special Assessments for Public Improvements

Differences in the extent to which various localities depend upon special assessments for the financing of public improvements can be seen by comparing the magnitude of special assessments for different areas or by relating levies for special assessments to general property taxes. In California, the San Diego \$5 annual per capita charge for special assessments suggests that this method

of financing public improvements is depended upon to a greater extent than it is in Los Angeles, where the annual per capita charge for special assessments averages \$2.55. In San Francisco, the dependence upon special assessment financing is even less, the annual per capita charge for special assessments being about 19 cents. A comparable disparity in the degree to which cities rely on special assessment financing has been noted in Indiana: the annual per capita charge varies from about \$3 in Fort Wayne to only 6 cents in Terre Haute.

Comparison of the amounts raised by special assessments and by general property taxes provides another indication of the important reliance that some communities place on the use of special assessments. In some cases, special assessment levies have equated or exceeded revenues from general property taxes although, as has been indicated, the ratio between revenues raised by property taxes and by special assessments has been quite constant for the country as a whole during recent years. For example, in a number of communities such as North Hempstead and Tonawanda, N.Y., and Gilroy and Los Altos, Calif., revenues in 1957-58 from special assessment levies were almost double those obtained from general property taxes.

Use of special assessments is fairly common; this method of financing is being used or is available for use in most American cities. In a survey of cities with populations of more than 10,000, conducted in 1959 by the International City Managers' Association, nearly 80 percent of the cities responding reported some use of special assessments. More than a third of the 14,472 autonomous special districts, excluding school districts, have the authority to levy special assessments. In California alone, some 2,982 special districts have authority to levy special assessments. In New York City, in 1958, the

Board of Assessors approved 100 sewer and 97 highway projects, thereby causing the creation of 197 special assessment districts.

Purpose of Special Assessment

The International City Managers' Association survey, previously mentioned, also provided information on the purposes for which special assessments are used. More than 700 of the 876 cities responding indicated that special assessment levies were used to finance the paving of new streets. Some of the other major purposes for which special assessments were used included financing for curbs and gutters, sanitary sewers, and sidewalks.

The major purposes for which special assessments were used and the number of cities employing this financing procedure for each purpose are shown in the following list.

Purpose	No. of cities
New street paving.....	712
Curbs and gutters.....	665
Sanitary sewers.....	641
Sidewalks.....	631
Storm sewers.....	287
Waterlines.....	261
Repaving streets and alleys.....	222
Street lighting facilities.....	152
Off-street parking.....	68
Miscellaneous improvements.....	34

Special assessments are utilized for many purposes other than the fairly common ones indicated in the foregoing list. In some instances, special assessments are used for financing both the original cost of an improvement and its maintenance costs. Often they are financed partially by special assessment levies against property near the facility and partially by general property taxes.

The wide variety of purposes for which special assessments are levied is indicated by the 66 different functions or facilities that have been financed by special assessments in California. These ranged from the more common facilities and activities such as libraries, highway lighting, and fire protection—with more than 400 special assessment districts for each of these—to activities and facilities such as debris basin maintenance, mosquito abatement, parking, citrus pest control, separation of grade, transit, and water storage. In Los Angeles, an ordinance requires the demolition of dangerous and obsolete buildings and, in the absence of compliance therewith, permits this work to be done by the city and its cost recovered by a special assessment against the land. Special assessment procedures have even received some consideration as a means of financing slum clearance programs. Justification for such a use would be similar to that for other special assessment proposals—that the surrounding area, because of the benefits from the slum clearance, could be expected to meet at least part of the cost of the program.

As might be expected, purposes for which special assessments are used have changed over the years. Thirty years ago special assessments were used to a considerable extent for

financing rural roads; today they are being used increasingly to finance street lighting, particularly ornamental lights, and for rehabilitation of downtown areas. Special assessments for rehabilitation projects may be imposed for such specific purposes as parking lots, malls, parks, etc. For example, to rehabilitate a downtown area, Royal Oak, Mich., used special assessment financing to provide a series of parking lots and malls. In this case, half the cost was met by an *ad valorem* levy against the downtown district and half by a graduated front foot charge.

Special Assessments for Highways

Highways and streets are quite analogous to such public activities as waterworks and sewers. While these facilities ordinarily provide more benefit to those using them than to other people in the community, most people, whether users or nonusers, are benefited to some degree from the existence of the facility. It has been deemed reasonable, therefore, to charge both users and nonusers for construction of the facility. A fairly common procedure, used for allocating the cost of major streets or highways between highway users and abutting owners, is to charge abutting property owners for a portion of the cost of arterial facilities equal to the cost of an access street or road. In the case of major highway improvements, the benefit deemed to accrue may be fairly widespread. For example, when Chicago's 12th Street was widened at a cost of \$3.3 million, properties within an area of a little more than 5 square miles were deemed to be benefited and special assessments that amounted to nearly half of the original cost were levied against these properties—special assessments totaled \$1.5 million.

The nonuser charge may be imposed either as a property tax or a special assessment, or both. The fairly stable relationship between the total amount of municipal funds being raised as general revenues and as special assessments has been referred to previously. As shown in table 1, the relationship between the amounts that municipalities raise for highways as general revenues and as special assessments also has been fairly stable in recent years.

Whether special assessments can be used as a means of providing equitable financing for a public activity depends primarily on the extent of the benefits involved. The American public and the courts have accepted the principle that, as a local street benefits adjacent property, it is equitable and reasonable to expect the property owners involved to pay at least a portion of the cost. Also, it generally has been recognized that the benefits provided by a major highway extend beyond the limits of the abutting properties. Now, more than in the past, highways are built primarily to serve highway users. Thus, while boulevards, parkways, and other major arterials formerly were financed partially by special assessments—and to some extent still are; for example, in Minneapolis and St. Paul, Minn., Milwaukee, Wis., and Detroit, Mich.—major highways now are being financed primarily from user revenue.

Table 1.—Receipts for highways from property imposts

Year	General property tax (1,000 dollars)	Special assessments	
		Amount, 1,000 dollars	Percentage of general tax
URBAN			
1957.....	298,270	104,807	44
1958.....	159,120	98,756	62
1959.....	352,038	86,887	57
1960.....	131,796	76,719	53
1961.....	158,999	71,870	58
1962.....	138,013	50,847	41
1963.....	191,312	41,701	32
1964.....	113,039	39,879	35
1965.....	96,855	41,800	46
RURAL			
1957.....	472,807	11,387	2
1958.....	454,080	9,911	2
1959.....	428,198	9,908	2
1960.....	413,859	6,360	2
1961.....	397,541	5,821	1
1962.....	379,648	5,942	2
1963.....	367,824	4,980	1
1964.....	355,475	5,080	2
1965.....	377,980	2,291	1

1 Of 108 amount, \$1,262,000 was spent in Illinois.
2 Of 108 amount, \$2,390,000 was spent in Illinois.

Application of Infrared Spectroscopy to Bituminous Mineral Filler Evaluation

BY THE DIVISION OF PHYSICAL RESEARCH
BUREAU OF PUBLIC ROADS

Reported ¹ by **BERNARD CHAIKEN, Chemist;**
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Problems encountered in classifying the minerals from material in a specific natural mineral deposit, which was intended for use as a filler in bituminous concrete, provided the basis for the research reported in this article. After chemical and petrographic examination of material from this deposit resulted in an uncertain classification, particularly as to whether kaolinite or other clay minerals were present, various techniques were employed by the Bureau of Public Roads in an attempt to classify the minerals and, more specifically, to determine the suitability of the material for bituminous construction. It is believed that the experiences from this research study will be helpful to others encountering a similar problem.

The methods used and the results obtained in this study are reported here. By resorting to a combination of instrumental methods, physical tests, and chemical analysis, the clay mineral nature of the material and its potential behavior as a filler for bituminous concrete were determined. The methods utilized in the study included infrared spectroscopy; x-ray diffraction; differential thermal analysis; fineness, surface area, and plasticity tests; chemical analysis; immersion-compression tests of bituminous concrete mixtures; and softening point tests of asphalt-filler mortars. Emphasis in this report has been placed upon the use of infrared spectroscopy for identifying the clay-like nature of the filler.

Introduction

BECAUSE OF the difficulties related to evaluating the suitability of mineral fillers for bituminous mixtures solely on the basis of their physical characteristics, the Bureau of Public Roads has been conducting research to determine the usefulness of new instrumental means for determining the mineralogical nature of fillers—such information to be used as a supplement to that obtained from physical tests. Bituminous technologists are well-aware of the fact that the properties and performance of a bituminous mixture can be influenced greatly by the fraction of aggregate that passes the 200 mesh sieve. It is also known that the effect of this fraction, generally referred to as the filler, on a bituminous mixture cannot be predicted precisely from the easily measured characteristics of the filler itself. The difficulties encountered and some of the relationships between various laboratory tests have been discussed by Warden, Hudson, and Howell (1)² in a recent evaluation of a num-

ber of filler materials. A general classification of materials on the basis of several tests has been provided in their work but, as they have pointed out, it is impossible to evaluate properly the suitability of a filler on the basis of its physical characteristics alone.

The evaluation of fillers, by noting their behavior either in combination with asphalts or in bituminous concrete mixtures, is made complex by the effect of variations in the test specimens or differences in the properties of the supplementary materials. For example, the immersion-compression test (2) generally is used to determine the effect of water on composite specimens of aggregate, filler, and binder. Various laboratories, however, sometimes reach different conclusions as to the effect of a specific filler material because of variations in the type and grade of the aggregate and/or the proportion and characteristics of the asphalt used in the mixture.

The primary objective of the study conducted by Public Roads was to evaluate the potential suitability of a specific deposit of finely divided natural mineral proposed for use as a filler in bituminous concrete. An uncertain classification of the minerals present in this material had been obtained by others

from limited chemical and petrographic examinations. In particular, a question existed as to whether kaolinite or other clay minerals were present in this material. The use of conventional procedures and various special techniques used to evaluate this material are discussed in this article. It is believed that the experience reported here, particularly as to the special techniques, may be helpful as a guide to others confronted with a similar problem. Techniques used during this research included x-ray diffraction, differential thermal analysis, and infrared spectroscopy.³ Special emphasis has been placed upon the use made of infrared spectroscopy to identify the clay-like nature of the filler material from this deposit.

The studies made with each of the various techniques used in the analysis of the material from the deposit were carried out more or less independently, and data resulting from the use of each of the techniques is presented separately. Because the use of infrared spectroscopy as a means of evaluating the mineral characteristics of filler material is relatively new, details on the application of this technique and the manner of interpreting the results have been presented. As literature is readily available concerning procedures and techniques for x-ray diffraction, differential thermal analysis, and chemical analysis, detailed descriptions have not been included for these applications.

Gradation, General Properties, and Classification of Material

Eight samples, representative of different areas of the deposit, were taken directly from the ground and from material previously obtained from the deposit and stored in stockpiles and storage bins. Results of mechanical analysis, surface area measurements, and soil classifications are given in

¹ Presented at the 41st annual meeting, Highway Research Board, Washington, D.C., January 1962.

² References indicated by italic numbers in parentheses are listed on page 52.

³ The authors extend their appreciation to E. B. Kinter and S. J. Diamond, Highway Research Engineers, Bureau of Public Roads, who interpreted the data relating to differential thermal analysis, surface area, and x-ray analysis.

Table 1.—Physical properties of mineral fillers

	Filler material from test deposit, sample numbers—								Control fillers	
	1	2	3	4	5	6	7	8	Lime-stone dust	Gran-ite dust
Grading:										
Filler passing sieve:										
No. 10..... percent.....	100	100	-----	100	-----	100	100	100	-----	-----
No. 40..... do.....	99	99	-----	99	-----	99	99	99	100	-----
No. 80..... do.....	99	99	100	99	100	99	98	99	99	100
No. 200..... do.....	95	95	97	97	98	96	96	97	89	97
Filler smaller than (mm):										
0.650..... percent.....	92	93	95	95	96	94	95	95	73	62
.020..... do.....	70	70	72	73	78	72	77	77	27	22
.005..... do.....	26	24	26	28	34	26	37	30	8	5
.002..... do.....	2	2	2	2	6	6	11	4	5	1
.001..... do.....	0	0	0	0	1	2	3	1	4	0
Surface area:										
Square meters per gram ¹	7	7	7	7	² 18	7	² 18	7	0.2	0.1
Liquid limit.....	33	31	34	34	48	34	39	34	-----	-----
Plasticity index.....	7	5	6	7	11	6	10	7	³ NP	³ NP
AASHTO classification.....	A-4(8)	A-4(8)	A-4(8)	A-4(8)	A-7-5 (10)	A-4(8)	A-4(8)	A-4(8)	A-4(8)	A-4(8)

¹ Approximations obtained by glycerol retention method.
² Comparatively high values are believed to have been caused by greater amount of vermiculite present in samples 5 and 7

³ Nonplastic.

table 1. Also shown in the table are characteristics of the two control fillers that were used in subsequent evaluation tests.

All eight samples of the natural filler material had plastic properties; the plasticity indices varied from 5 to 11 and the liquid limits from 31 to 48. With the exception of samples 5 and 7, surface areas as determined by the glycerol-retention method were 7 square meters per gram. This value was less than might be obtained for a pure clay such as kaolinite, approximately 20 square meters per gram, but was substantially higher than the values for the control fillers of limestone and granite, which had surface

areas respectively of 0.2 and 0.1 square meter per gram, as can be seen in table 1.

On the basis of these conventional tests as well as infrared spectroscopy and x-ray analysis, which will be discussed later, three samples—2, 5, and 8—considered as representing the maximum differences in composition of the various areas of the deposit were selected for special studies in combination with asphalt. The effect of the natural filler on the properties of bituminous mixtures was determined by the immersion-compression test. The effect of these samples on the softening point of filler-bitumen mortars also was determined.

**Table 2.—Immersion-compression test results
(Each value shown is the average for three specimens)**

Characteristics determined	Specimens containing—				
	Limestone dust	Granite dust	Filler material from samples—		
			No. 2	No. 5	No. 8
Bulk specific gravity.....	2.244	2.255	2.281	2.277	2.281
Void characteristics, percentage:					
Air voids.....	8.8	8.5	6.9	6.9	7.3
Mineral voids.....	23.1	22.8	21.4	21.3	21.8
Mineral voids filled.....	61.8	62.6	67.6	67.6	66.5
Compressive strength data, p.s.i.					
No immersion.....	296	302	347	346	342
After immersion at 120° F. for:					
4 days.....	230	241	191	207	217
7 days.....	213	217	138	163	185
14 days.....	196	198	100	113	121
Retained strength, percentage:					
No immersion.....	100	100	100	100	100
After immersion at 120° F. for:					
4 days.....	78	80	55	60	64
7 days.....	72	72	40	47	54
14 days.....	66	66	29	33	38
Swell, percentage:					
After immersion at 120° F. for:					
4 days.....	1.0	1.0	2.2	1.8	1.7
7 days.....	1.5	1.5	3.4	2.7	2.2
14 days.....	1.4	1.5	4.8	3.8	3.3

Immersion-Compression Tests

Immersion-compression tests were made with the three selected samples to determine the effect of the natural filler materials on the strength properties of a bituminous concrete mixture. For comparison, the same tests were made with two control fillers: a limestone dust and dust from a crushed granite aggregate. The gradation of the combined aggregate and filler used in the bituminous mixture for the immersion-compression test conformed to that of a typical wearing course mixture, as follows:

Sieve size	Percent passing
½ inch.....	100.0
¾ inch.....	98.5
No. 4.....	85.0
No. 10.....	67.0
No. 40.....	33.0
No. 80.....	15.0
No. 200-Pan (mineral filler).....	6.5

Each of the fillers was sieved to remove all material retained on the 200 mesh sieve and the portion passing this sieve was used to constitute the entire fraction shown as No. 200-Pan.

Each mixture contained 6.50 percent asphalt on a total mix basis. Characteristics of the asphalt were: Specific gravity, 1.016; softening point, 118° F.; penetration (100 grams, 5 seconds at 77° F.), 93; ductility (5 centimeters/minute at 77° F.), 230 centimeters.

Bituminous concrete mixtures were prepared with filler material from each of the three samples (2, 5, and 8) and each of the two control samples. The aggregate for each mixture, including the filler, was blended and heated overnight at a temperature of 325° F. and, prior to mixing, the asphalt was heated to a temperature of 290° F. The hot aggregate and asphalt were mixed together for 2 minutes in a modified Hobart mechanical mixer and the mixture immediately was molded into cylindrical specimens by the double-plunger method at 3,000 p.s.i. held for 2 minutes. Twelve specimens, 3 inches high and 3 inches in diameter, were molded with each of the five fillers—a total of 60 specimens. These specimens were cooled to room temperature and then placed in an oven at a temperature of 140° F. to cure for 24 hours.

The 12 specimens of each mixture were divided into 4 groups so that the average bulk specific gravity of each group of 3 specimens was the same. These groups were then tested for compressive strength at 77° F., one group without having been immersed, and each of the other groups after having been immersed in water at 120° F. for 4, 7, and 14 days, respectively. Average test values for each of the groups are shown in table 2. Results also are shown for void characteristics, compressive strength prior to immersion, and compressive strength and percent of swell after immersion.

The molded specimens containing the natural fillers, samples 2, 5, and 8, had lower

percentages of air voids and higher percentages of mineral voids filled with asphalt than the specimens containing limestone and granite dust fillers. Without immersion, the compressive strengths of the specimens containing natural fillers were higher than those of the specimens containing the control fillers. However, after immersion the strength of the specimens with the natural fillers decreased at a much higher rate. The mixtures prepared with the natural fillers would not be acceptable under the criterion used by the Bureau of Public Roads, which requires a minimum of 70 percent retained strength after 4 days of immersion in water at a temperature of 120° F. The mixtures containing the limestone and granite dust would be considered satisfactory. Both the high percentage of swell and the large loss of compressive strength of the specimens containing natural fillers indicate that materials of this type are water-susceptible and may not be satisfactory for highway construction.

Softening Point of Asphalt-Filler Blends

Previous studies, reported in references 1, 3, and 4, have shown that the properties of blends of filler and asphalt are indicative of the effectiveness of mineral fillers. To compare the natural fillers and the two control fillers used in this study, various blends of asphalt and filler were prepared and their

softening points determined by the Ring and Ball method. The results of these tests are given in table 3, and the relations of the volumetric filler-bitumen ratios to the softening points of the different blends are shown in figure 1.

Blends prepared from samples 2, 5, and 8 showed a much higher rate of increase in softening point than the blends with the two control fillers. This can be attributed partially to the higher surface area of the natural fillers. Blends containing sample 5 showed the greatest increase in softening point, and the curve for these blends is similar to a curve developed for kaolin by Warden (1) and others. A moderate increase in softening point is desirable for increased stability but large increases are considered detrimental because they may result in brittleness of asphalt-aggregate paving mixtures.

Differential Thermal Analysis and X-Ray Diffraction

The combined results of differential thermal analysis and x-ray diffraction on the eight samples from the natural deposit are given in table 4. The results were conclusive with respect to the qualitative presence of kaolinite, quartz, and mica. The quantitative approximations of the amount of kaolinite were made by differential thermal analysis, and the estimates for quartz were obtained by x-ray diffraction. These estimates were made to the

nearest 5 percent, which for these minerals is the limit of precision for the techniques used. Although the x-ray patterns very definitely indicated the presence of mica, quantitative estimates could not be made with these techniques. Consequently, mica was estimated by difference. Therefore, any other minerals or amorphous material that may have been present were included with the amount shown for mica, in table 4.

As shown in table 4, the composition of the eight samples from different locations in the deposit was not uniform. The percentage of kaolinite varied from 10 to 45, that of quartz from 10 to 30, and the balance, which included the mica, varied from 45 to 65 percent. Although not shown as a major constituent in table 4, the presence of vermiculite was detected in all samples; 0.7 percent was estimated to be present in all samples except 5 and 7, and

Table 3.—Softening points of filler-asphalt blends¹

Test material	Specific gravity	Filler-asphalt blends		
		Filler-bitumen ratio—		Softening point, ° F.
		By volume	By weight	
Limestone dust	2.71	0.18	0.49	119
		.36	.96	126
		.54	1.44	134
		.70	1.97	149
Granite dust	2.79	.18	.49	123
		.35	.97	131
		.53	1.44	145
		.68	1.87	² 180+
Sample 2	2.70	.19	.50	126
		.37	.99	143
		.53	1.40	176
		.74	1.97	³ 271
Sample 5	2.69	.19	.49	127
		.37	.93	151
		.56	1.47	³ 230
Sample 8	2.70	.19	.50	126
		.37	.99	147
		.49	1.30	174
		.66	1.75	³ 234

¹ Softening point of the asphalt with no filler was 118° F. and all filler material used in the blends had been dry screened so that 100 percent passed the 200 mesh sieve.

² Sample fell from test mold at 180° F.

³ Glycerine bath.

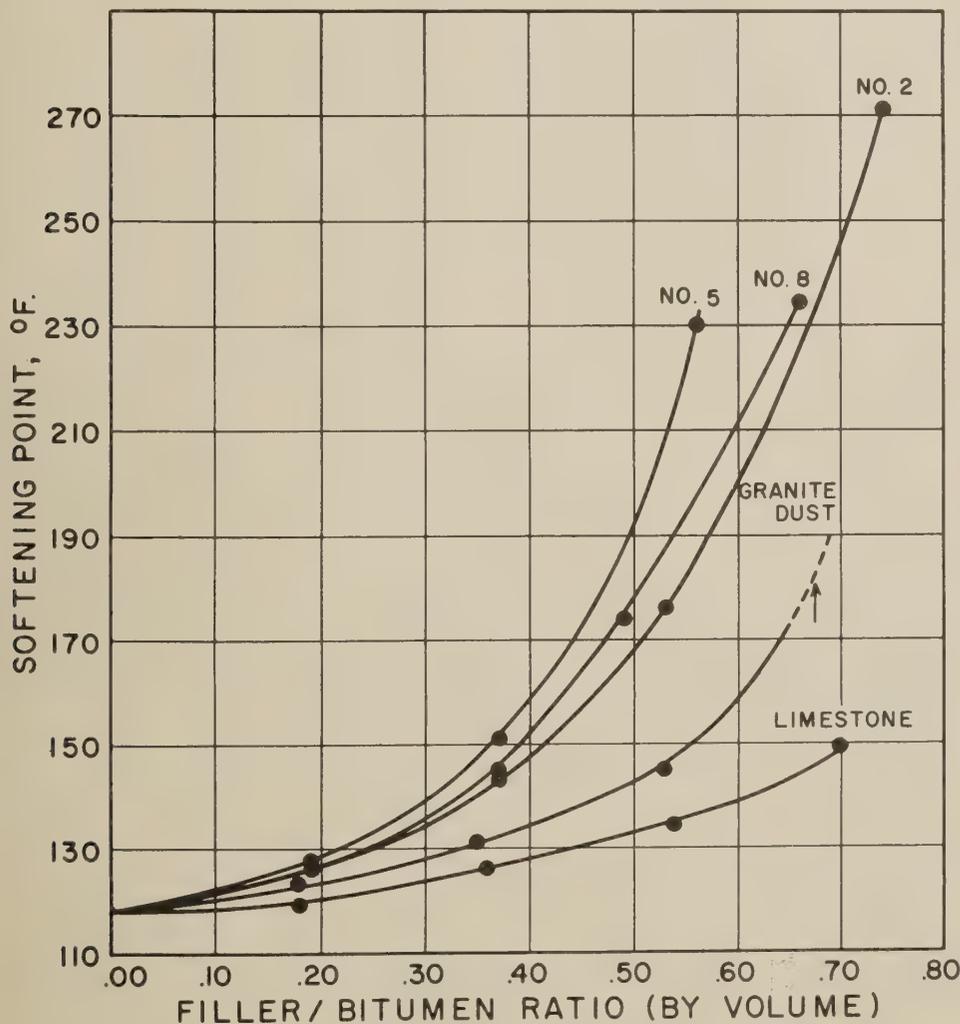


Table 4.—Mineral content of filler determined by differential thermal analysis and x-ray diffraction¹

Sample number	Mineral content—		
	Kaolinite ²	Quartz ³	Balance (including mica) ⁴
	Percent	Percent	Percent
1	15	25	60
2	10	30	60
3	15	20	65
4	20	20	60
5	45	10	45
6	25	25	50
7	20	20	60
8	15	25	60

¹ Results estimated to the nearest 5 percent.

² Estimated from differential thermal analysis.

³ Estimated from x-ray diffraction patterns.

⁴ The presence of mica was established by x-ray diffraction. Approximately 0.7 percent of vermiculite was present except for samples 5 and 7 with approximately 1.5 percent. Amorphous materials that may have been present also are included in the percentages shown.

Figure 1.—Relation of filler material to variation in softening point of filler-bitumen mortars.

it was estimated that they contained 1.5 percent. Because of the very large surface area of vermiculite, differences of such magnitude in the vermiculite content of a filler are significant and, in this case, accounted for the differences in the surface areas previously noted for samples 5 and 7 (table 1). The high liquid limits and plastic indices for these two samples also can be accounted for on the basis of vermiculite content.

Chemical Analysis

Results from the limited chemical analyses of the eight samples of natural filler material are shown in table 5. These results tended to confirm the more specific findings from the x-ray analysis. The substantial ignition loss that was noted is indicative of combined water, such as is found in clay minerals. Although by no means conclusive evidence, the appreciable potassium oxide content, as compared with very little sodium oxide, suggested that the bulk of the mica found by x-ray diffraction was of the muscovite type. The estimate of the amount of muscovite mica present was based therefore on an empirical calculation from the potassium oxide content. The higher ignition loss for sample 5 confirmed the x-ray diffraction findings that this sample had the largest clay content of any of the eight samples.

INFRARED SPECTRAL ANALYSIS

As previously noted, the application of infrared spectroscopy to a problem involving the identification of minerals in natural filler material is relatively new. Therefore, the procedures used in this portion of the study are described in greater detail, and the results are discussed with reference to the findings from more familiar techniques.

Instrument and Its Operation

A double-beam spectrophotometer with automatic recording, as described in a previous report (5), and having a sodium chloride prism for operation at wavelengths of between 2.5 and 15 microns, was used for this study. Complete scanning time was approximately 12 minutes. The sample was prepared for analysis by the potassium bromide (KBr) disk method. This method involves dispersing a minute amount of test sample in powdered potassium bromide, pressing the mixture into a disk, and recording the transmitted infrared spectrum of the disk. Because KBr does not absorb significant infrared energy in the wavelength range used for this study, the resultant spectra are characteristic of the test samples alone. Details of this procedure are described in the following paragraphs.

Samples of filler material were ground to a fine powder with mortar and pestle and dried at a temperature of 105° C. for at least 24 hours. Weighed samples of approximately 1 milligram were added to 0.35 gram of KBr (anhydrous spectroscopic grade, 200/325 mesh) and placed in a stainless steel capsule. Two stainless steel balls were added, and the contents were mixed for 30 seconds in an electric,

Table 5.—Chemical analysis of natural filler material

Sample number	Moisture loss at 105° C.	Loss on ignition between 105° and 950° C.	Potassium oxide, K ₂ O ¹	Sodium oxide, Na ₂ O ¹	Muscovite mica, by empirical calculation ²
	Percent	Percent	Percent	Percent	Percent
1.....	0.12	3.8	3.23	0.20	40
2.....	.10	3.2	3.13	.20	35
3.....	.08	3.8	3.13	.20	35
4.....	.15	3.8	3.18	.23	35
5.....	.47	8.1	2.16	.28	25
6.....	.22	5.9	2.49	.25	30
7.....	.53	5.2	2.61	.19	30
8.....	.10	3.6	2.93	.20	35

¹ Calculated on oven-dry basis.
² Computed to nearest 5 percent from potassium oxide content by assuming that muscovite mica contains an average of 8.5 percent (6).

dental-type amalgamator. The mixed powder was transferred to a special die and the assembly was evacuated to a pressure of less than 1 centimeter of mercury. While the vacuum was maintained, a total load of 20,000 pounds was applied to the die for several minutes. The pressed disk was removed from the die with tweezers and analyzed in the infrared spectrophotometer. Each disk measured 13 millimeters in diameter, 1 millimeter in thickness, and had a fairly transparent appearance.

Spectra

The infrared spectrum recorded for each of the eight samples has been reproduced in figure 2. (The spectra shown in figures 2-4 are included in this article only for illustrative purposes; detail has been lost in reproduction processes.) The spectra had characteristics attributable to materials with a layered silicate structure similar to clay, and they also revealed the presence of quartz. One of the clay minerals could be identified clearly as kaolinite from a comparative study of published spectra of clay minerals. To confirm this, a comparison of pertinent reference spec-

tra of kaolinite, quartz, and muscovite is shown in figure 3. The spectrum for quartz characteristically has a prominent double peak (downward dip) between 12.5 and 12.8 microns. Kaolinite has an interesting spectrum that includes a sharp peak at 9.0, a doublet or double peak at 9.65 to 9.9, and another peak at 10.9 microns. The kaolinite spectrum is characterized also by a slight shoulder on the low wavelength side of the latter peak which occurs at about 10.6 microns. The spectrum for muscovite is characterized by major peaks at about 10.0 and 10.9 microns. The spectra for both kaolinite and muscovite are characteristic of the layered silicates, that is, clay minerals.

The spectra for both kaolinite and muscovite in this study showed double peaks in the 2.7 to 3.0 micron area, which is characteristic of clay structures. The 2.7 micron peak was produced by unbonded hydroxyl (OH), and the 2.9 peak was caused by bonded hydroxyl. In these spectra the 2.9 peak was somewhat enhanced by the effect of the KBr powder itself, which contained unremovable moisture; this was evident also in the spectrum for quartz where the 2.9 peak was caused by moisture in the KBr pellet.

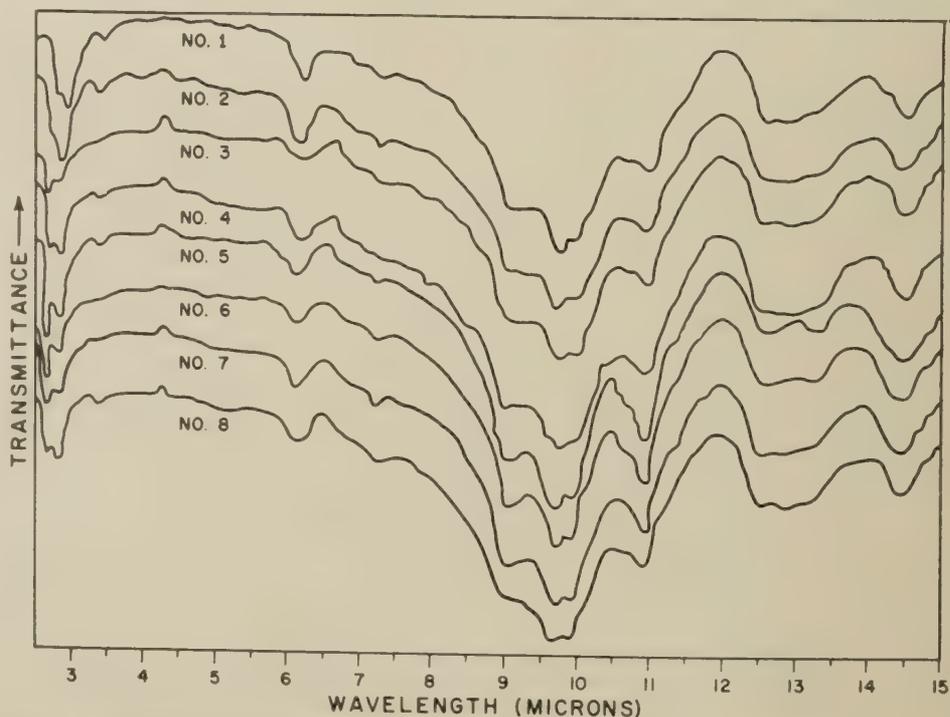


Figure 2.—Infrared spectra of eight samples of material from deposit under test.

For a more direct comparison and evaluation, the spectrum of the filler in sample 5 was replotted, as shown in figure 3, because it exhibited the closest similarity to the kaolinite spectrum. From this comparison the following conclusions were drawn and are applicable in varying degrees to the material in the other seven samples.

Quartz

The presence of quartz in sample 5 was apparent from the prominent peak in the spectrum between 12.5 and 12.8 microns. The true doublet formation in this area, which is characteristic of quartz, was largely attenuated in the sample 5 spectrum because of the background effect of other materials.

Kaolinite

The presence of kaolinite in sample 5 was evident from the prominent peak in the spectrum at 9.0, the doublet at 9.65 to 9.9, and the peak at 10.9 microns. The slight shoulder at 10.6 microns also confirmed the presence of kaolinite. The peak at 9.0 microns was not as sharp as in the kaolinite spectrum, perhaps as a result of the additive background effects of quartz and other substances in the sample filler material. The kaolinite pattern was most pronounced in the spectra for samples 5, 6, and 7 (fig. 2) and this is in conformity with the differential thermal analysis and loss on ignition data, as can be seen by referring to tables 4 and 5.

Muscovite

Because all the major infrared peaks of muscovite appear at wavelengths common to some of the kaolinite peaks, it was impossible to confirm the presence of muscovite in the filler material by infrared spectroscopy alone. The presence of muscovite was inferred, however, from the combination of the chemical data—potassium oxide determination—and the slope and slight bulge in the infrared pattern in the 10.2 micron area. This infrared characteristic was slightly more obvious in the spectra for the other materials than for that from sample 5. Nevertheless, on the basis of the infrared data alone, it cannot be said with certainty that muscovite was present.

Presence of Clay Confirmed

Because the clay mineral structure is destroyed by ignition, the use of infrared spectroscopy was explored to provide additional pictorial confirmation of the presence of clay minerals by examination of spectra from the filler material after it had been ignited. It is known that, specifically in the case of kaolinite, ignition at temperatures between 600° and 900° C. produces a metakaolin and, consequently, the 10.9 micron peak in the spectrum is destroyed because of the dislocation of the octahedral sheet. Spectra of unignited kaolinite, ignited kaolinite and muscovite, and ignited material from sample 6 are shown in figure 4. Ignitions were made at a temperature of 600° C. for several hours. By noting the absence of the characteristic peaks in the various spectra—that is, the 2.7 micron

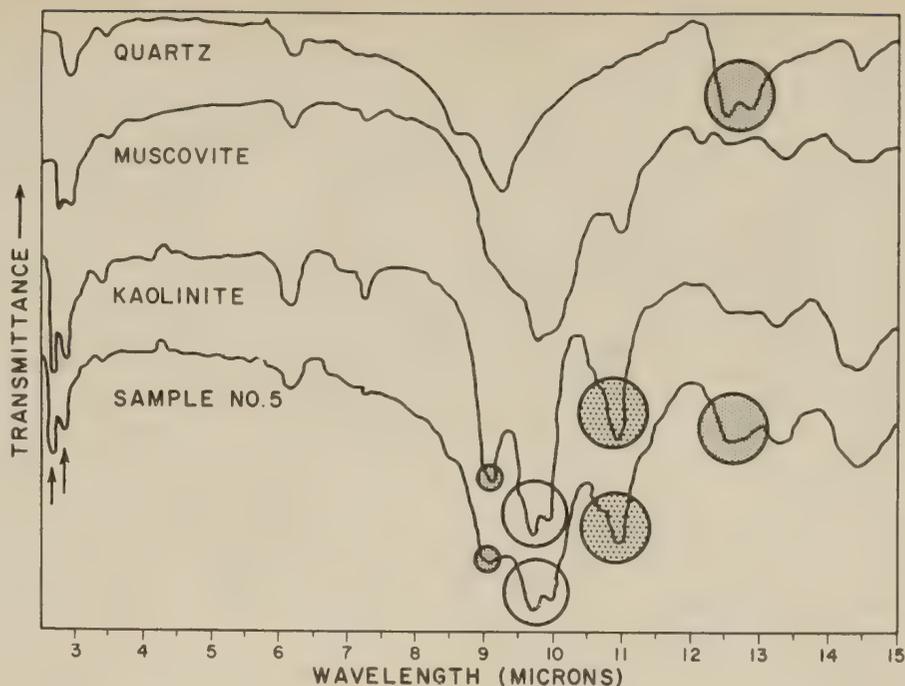


Figure 3.—Comparison of infrared spectra of reference materials with spectrum of sample 5 from the deposit under test.

peak of unbonded hydroxyl and the 10.9 micron peak of a layered silicate—it can be seen that in all cases the ignition destroyed the clay minerals.

The evidence from examination of the spectra of these materials after ignition strongly supports the conclusion that significant amounts of clay minerals were present in the original samples of the natural filler material. It was noted that the quartz peak of 12.5 microns in the spectrum of the ignited sample 6 remained unaffected by the ignition. As heating would have little effect on quartz, this would be expected. Note that the spectrum for the ignited sample 6 appears to

resemble a composite of the spectrum of ignited kaolinite and muscovite, except for showing the influence of quartz.

Findings Concerning Techniques

On the basis of this study, it is believed that further research is warranted on the application of the techniques of differential thermal analysis, x-ray diffraction, and infrared spectroscopy to problems of the type described in this article. These techniques are expected to be helpful in explaining the varying effects that material passing the 200

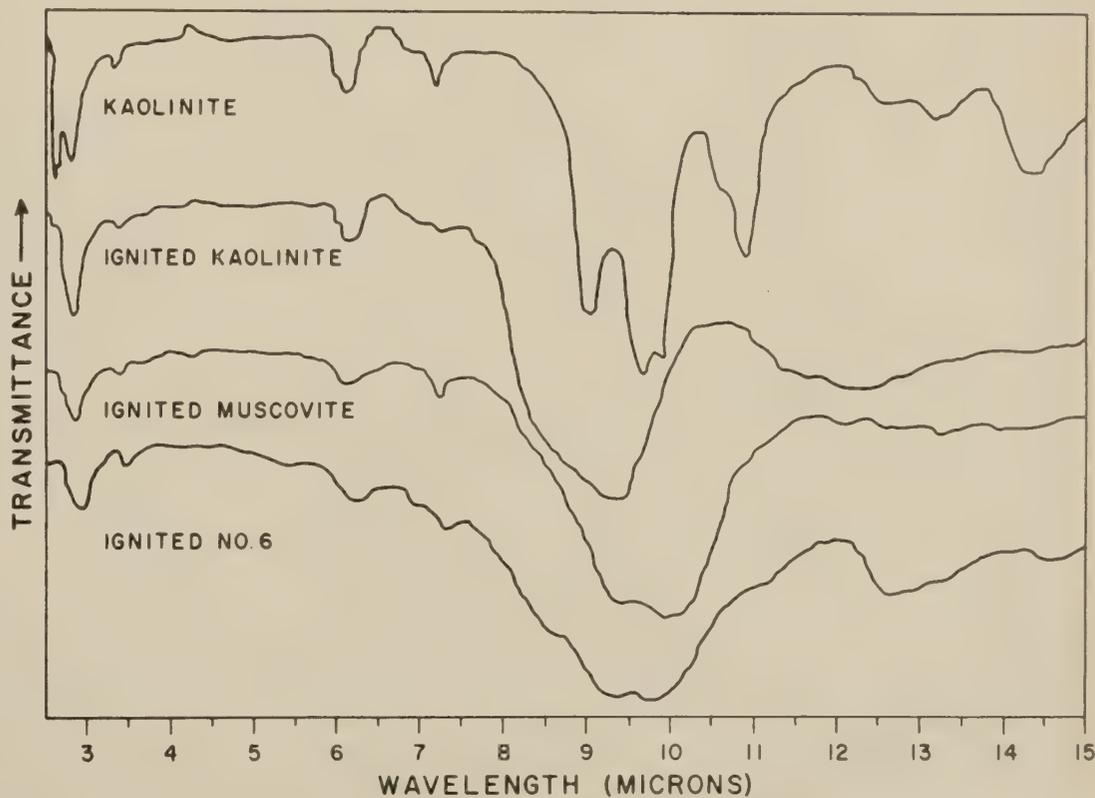


Figure 4.—Comparison of effect of ignition on spectra of minerals and spectrum of sample 6 from the deposit under test.

mesh sieve has on bituminous mixtures, and in interpreting the results of immersion-compression and mortar tests in screening new sources of material. This article is presented primarily to illustrate the usefulness of these various techniques in identifying the components of fillers proposed for use in bituminous concrete.

Usefulness of the techniques discussed here was determined in connection with performance tests on mixtures of asphalt-aggregate-filler and filler bitumen systems conducted to evaluate the suitability of a proposed filler from a specific deposit. Positive identification of the major minerals contained in this proposed filler were made by differential thermal analysis, x-ray diffraction, and infrared spectroscopy. These techniques should be helpful for evaluating the mineral content and determining the uniformity of other potential sources of filler material for bituminous concrete mixtures. Results obtained also provided a basis for quantitative estimates of the relative amounts of each mineral present in the proposed filler. No attempts were made in this study, however, to relate the quantitative amounts of the various minerals in the proposed filler to its performance.

An important possibility from application of these techniques is the ability to determine the uniformity of the supply of material from natural deposits, such as that examined in this study. It is important that the varying characteristics of filler material be known so that fluctuations can be avoided in bituminous mixtures that would affect pavement performance. Differential thermal analysis, x-ray diffraction, and infrared spectroscopy showed that all eight samples of the material under test were of similar composition. However, a considerable degree of nonuniformity between samples was indicated by the quantitative estimations, especially as to kaolinite content. Such nonuniformity in a filler easily could cause conflicting results from samples taken from different areas of a deposit; this nonuniformity would be a practical problem in the use of such materials in actual construction.

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